TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY

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Dedicated

to

my family

&

Teachers

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ABBREVIATIONS

apo B	Apolipoprotein B
ASCVD	Atherosclerotic Cardiovascular Disease
BS	Bariatric Surgery
BPD	Biliopancreatic diversion
BMI	Body Mass Index
CRP	C-reactive protein
EWL	Excess weight loss
GLP-1	Glucagon-like peptide-1
GIP	Glucose-dependent insulinotropic polypeptide
HDL	High Density Lipoprotein
IGT	Impaired glucose tolerance
IL-6	Interleukin 6
LGB	Laparoscopic gastric banding
LPJB-SG	Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy
LRYGB	Laparoscopic Roux-en-Y gastric bypass
LSG	Laparoscopic sleeve gastrectomy
LDL	Low Density Lipoprotein
NIH	National Institute of Health
NAFLD	Non-alcoholic fatty liver disease
NCDs	Non-communicable diseases
NPY	Neuropeptide Y

PYY	Peptide YY
PCOD	Polycystic Ovarian Disease
QOL	Quality of Life
RYGB	Roux-en-Y gastric bypass
SGJB	Sleeve gastrectomy with jejunal bypass
SIBO	Small intestinal bacterial overgrowth syndrome
TG	Triglycerides
TNF- α	Tumor necrosis factor-α
T2DM	Type 2 Diabetes Mellitus
VIG	Vertical isolated gastroplasty
WHO	World Health Organization

ABSTRACT

Introduction: Obesity is a major public health problem. Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy (LPJB-SG), a novel metabolic surgery dominates the bariatric scene and is effective in producing weight loss and in remission of type II diabetes in obese patients. It was first described by de Menezes in 2004.

Aim of Study: To study outcomes of LPJB-SG in terms of Weight loss, Nutritional status and Remission of type II Diabetes Mellitus.

Materials & Methods: The study was conducted in the Department of General Surgery, DMCH, Ludhiana from 1st September 2020 to 31st August 2022 on 40 obese patients undergoing LPJB-SG. It was both a retrospective and prospective study. In this study, height, weight, BMI, waist circumference, hip/waist ratio, fasting blood sugar, 2-hour post prandial glucose, glycosylated hemoglobin, blood pressure, lipid profile, body fat composition analysis and time in range by continuous glucose monitoring sensor were compared at the time of admission and at 4 months post-operatively.

Results: 40 obese patients with BMI>32 underwent LPJB-SG. Significant improvements were observed in various parameters at 4 months. Mean weight and BMI decreased by 24.07 ± 6.23 kg and 8.94 ± 2.34 kg/m^2. There was mean excess weight loss of 31.87%. Mean waist circumference and hip/waist ratio decreased by 9.04 ± 2.39 cm and 0.07 ± 0.02. Mean FBS, 2 HR-PP, HbA1c decreased by 52.30 ± 15.20 mg/dL, 57.15 ± 20.34 mg/dL, 0.88 ± 0.39 %. Mean TG decreased by 12.13 ± 6.05 mg/dL, LDL by 10.78 ± 4.94 mg/dL, and HDL increased by - 4.03 ± 2.84 mg/dL. The results showed insignificant difference in albumin levels. Parameters assessed by body composition analysis monitor showed significant results. Mean time in range improved by -12.90 ± 6.93 % at 4 months.

Conclusion: LPJB-SG resulted in significant improvement in terms of weight loss, long term remission of type II diabetes mellitus and to improve cardiovascular health in obese patients.

Keywords: Obesity, Bariatric surgery, type II diabetes mellitus, Sleeve gastrectomy, Jejunal bypass, BMI, FBS, HbA1c, TG, LDL, HDL.

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INTRODUCTION

The incidence of obesity and its related health issues has skyrocketed in Asia, home to 60% of the world's population who already face a higher risk of developing diabetes. Since 1975, obesity has increased threefold globally. In 2016, 1.9 billion adults over the age of 18 were overweight, with 650 million of them considered obese. 39% of adults were overweight and 13% were obese. In many countries, obesity is responsible for more deaths than underweight. In 2020, 39 million children under the age of 5 were overweight or obese, and in 2016, over 340 million children and adolescents between the age of 5-19 were also affected. The rise in obesity in Asia can be attributed to rapid urbanization, changes in dietary habits, and cultural shifts. [1-3]

It is widely acknowledged that, compared to Caucasians, Asians exhibit distinct physical traits and have a genetic predisposition to metabolic syndrome, increased body fat, and a higher risk of death from cardiovascular disease. [3-5]

Bariatric surgery (BS), also known as weight loss surgery, has undergone a significant evolution over the years. From its early beginnings in the 1950s, bariatric surgery has undergone various advancements and modifications, making it a safer and more effective option for those suffering from obesity. Initially, bariatric surgery was considered a last resort for those who had exhausted all other weight loss methods, and the procedure was considered very invasive and dangerous. However, as time went by, bariatric surgery underwent various technological advancements, making the procedure less invasive, and reducing the risk of complications. Today, bariatric surgery is considered a viable option for those with a BMI of 40 or higher, or for those with a BMI of 35 or higher who also have related health conditions such as diabetes, heart disease, and sleep apnea. With its continued evolution, bariatric surgery is now seen as a life-saving option for those struggling with obesity, providing them with the opportunity to achieve a healthier, happier life.

The field of bariatric surgery has undergone significant advancement over time, however, there is still room for improvement. As we gain a deeper understanding of the causes and maintenance of obesity, new and improved surgical methods must be developed. These innovations should take into account this newfound knowledge and aim to be at least as effective, if not more so, while minimizing any potential negative consequences, both in the short and long term.[6]

It is important to note that patients with obesity can have a diverse range of body mass index (BMI) and accompanying health conditions. A one-size-fits-all approach to surgery is not effective for these patients. Instead, a personalized surgical approach that takes into account the patient's unique physiology is necessary to achieve optimal outcomes and reduce adverse effects. Therefore, there is a need to expand the available surgical options.

Given the advancements in our understanding of how intestinal hormones contribute to obesity and diabetes, there is a clearer picture of how changing the gut anatomy can lead to weight loss and better control of metabolic syndrome. In light of this, it is appropriate to explore alternative methods or modifications that can produce similar results, but are less prone to long-term complications, easier to perform, and both reproducible and reversible.

The rise in obesity can be attributed to two key factors: the abundance of cheap and readily available foods, and the sedentary nature of many jobs. Obesity is a consequence of technological progress and a significant challenge for society. It also reflects the freedom of choice in a society where people have access to various food options and job opportunities. The primary physical impact of obesity is atherosclerotic cardiovascular disease (ASCVD), which is largely driven by type 2 diabetes mellitus (T2DM). However, obesity is also associated with other risk factors that contribute to ASCVD, collectively known as metabolic syndrome. Along with ASCVD and diabetes, obesity can lead to other medical issues such as fatty liver, cholesterol gallstones, sleep apnea, osteoarthritis, and polycystic ovarian disease (PCOD).

These conditions are often seen in individuals who have metabolic syndrome.[7]

Obesity is classified based on the BMI score, which is calculated by dividing the weight in kilograms by the height in meters squared. The classification of obesity is divided into five categories:

1.The BMI score that is considered healthy is between 18.5-24.9 kg/m^2

2. The BMI score between 25-29.9 kg/m2 is considered overweight

3.Class 1 obesity with a BMI score between 30-34.9 kg/m^2

4.Class 2 obesity with a BMI score between 35-39.9 kg/m^2

5.Class 3 obesity with a BMI score of 40 kg/m^2 or higher.

Some groups further categorize Class 3 obesity into Class 4 (superobesity) with a score between 50-59.9 kg/m^2 and Class 5 (super-superobesity) with a score above 60 kg/m^2. The term "morbid obesity," which used to describe a BMI score over 100 lb (45.4 kg) or 100% over ideal body weight, has been replaced by the more recent terms Class 3 obesity, extreme obesity, or clinically severe obesity.

Obesity is considered a primary contributor to cardiovascular disease due to its impact on other risk factors.[8] These risk factors include the well-known ones like hypercholesterolemia, hypertension, and hyperglycemia, as well as newer ones like atherogenic dyslipidemia, insulin resistance, proinflammatory state, and prothrombotic state. The relationship between obesity and these risk factors varies based on individual genetic and acquired characteristics. In most cases, those who develop ASCVD and are obese will have a combination of major and emerging risk factors, which make up the metabolic syndrome. This combination of risk factors can be referred to as metabolic risk factors.

Metabolic syndrome is a collection of risk factors in metabolism that include:

- Atherogenic dyslipidemia [serum elevations of triglycerides (TG), apolipoprotein B (apo B), and small low-density lipoprotein (LDL) particles plus low high-density lipoprotein (HDL)]
- Elevated blood pressure

- Elevated glucose associated with insulin resistance
- Prothrombotic state
- Proinflammatory state

A person can be diagnosed with metabolic syndrome if they have three of the following five criteria:

- Increased waist circumference (≥102 cm in men and ≥ 88 cm in women)
- Elevated triglycerides (≥150 mg/dl)
- Reduced HDL cholesterol (<40 mg/dl in men and < 50 mg/dl in women)
- Elevated blood pressure (≥130/85 mm Hg or on treatment for hypertension)
- Elevated glucose (≥100 mg/dl)

Individuals with diabetes (fasting glucose over 126 mg/dl) will also be considered to have metabolic syndrome if two other criteria are present. If a person meets the criteria for metabolic syndrome under the Adult Treatment Panel III guidelines, measuring the 2-hour postprandial glucose may lead to a diagnosis of diabetes (2-hour glucose over 200 mg/dl) or impaired glucose tolerance (IGT) (2-hour glucose 140-199 mg/dl). [1.8,9]

Obesity can be described as having too much body fat. A commonly used indicator of body fat content is the body mass index (BMI), which is calculated by dividing a person's weight (in kilograms) by the square of their height (in meters). A BMI between 25-29 kg/m^2 is considered overweight, while a BMI of 30 kg/m^2 or higher is defined as obesity. A more accurate way to determine obesity is through the measurement of percent total body fat, which can be done using various methods such as skin-fold thickness, bioelectrical impedance, or underwater weighing. For men, obesity is defined as having 25% or more body fat, while for women it is 35% or more. In clinical practice, measuring waist circumference is the best way to estimate obesity because excess abdominal fat is closely linked to metabolic risk factors. While subcutaneous adipose tissue is a larger compartment compared to

visceral fat, the latter, specifically truncal fat, is more closely related to these risk factors than gluteofemoral fat.[10]

There is a disagreement regarding the relationship between obesity and metabolic syndrome regarding the function of insulin resistance. It is common for individuals with multiple metabolic risk factors to be insulin resistant, leading to the belief that insulin resistance is the root cause of the metabolic syndrome. As a result, the metabolic syndrome is sometimes referred to as the insulin resistance syndrome. [11]

The link between insulin resistance and metabolic risk factors is still being studied through various pathogenic theories. However, it is clear that insulin resistance increases the risk for developing impaired glucose tolerance and type 2 diabetes. The relationship between insulin resistance and other metabolic factors is less clear and the connection between obesity and insulin signalling is highly complex. It is currently impossible to separate the impact of each factor on the other. There is evidence that genetic forms of insulin resistance play a significant role in the prevalence of the metabolic syndrome among the general population. [11,12]

The relationship between the brain and the body in terms of appetite stimulation and eating physiology has been acknowledged since Pavlov's time. The process of nutrient absorption starts prior to the actual consumption of food and this is demonstrated by the physiologic changes that occur in anticipation during the cephalic phase of ingestion, such as the secretion of different enteric hormones. [13]

The central regulatory centers of the brain and the visceral organs constantly interact during eating. This simple act stimulates complex neural networks and activates reward centers in the brain. Bariatric surgery has been shown to change the patterns of neural activation in response to food in the mesolimbic reward centers. This change results in a decrease in subjective appetite, emphasizing the significance of understanding how bariatric surgery affects the communication pathways of the entero-encephalic endocrine axis. This axis is crucial in regulating human appetite, nutrient intake, energy balance, and metabolism.[14]

Ghrelin, commonly referred to as the hunger hormone, is one of the first hormones to draw attention in relation to obesity and bariatric surgery. It is primarily produced by cells called P/D1 found in the stomach's fundus. Ghrelin levels rise when a person is hungry or before a meal and quickly decrease after eating. It triggers a state of increased appetite by activating the neuropeptide Y (NPY) neurons, which regulate both appetite and metabolism. A drop in ghrelin levels, such as after a meal, leads to a feeling of fullness. NPY is the main hormonal signal controlling nutrient intake and metabolism in the central regulatory centers of the brain and throughout the body as it is one of the most abundant neuropeptides in the human brain. Another hormone called peptide YY (PYY), which is similar in structure and function to NPY, is produced by L-cells in the small and large intestine and inhibits NPY neurons, resulting in the termination of feeding and nutrient intake.[15]

The surgical treatment of obesity, known as bariatric surgery, is only recommended for patients who are considered to have clinically severe obesity by the National Institutes of Health (NIH). There are two main types of bariatric surgery available for the treatment of morbid obesity:

1. Restrictive procedures such as laparoscopic sleeve gastrectomy (LSG) or laparoscopic gastric banding (LGB)
2. Gastric bypass operations such as Roux-en-Y gastric bypass (RYGB) or biliopancreatic diversion (BPD).

Other surgical options, such as intestinal bypass, jaw wiring, and liposuction, have not been proven to be effective, while gastric bubble and vagotomy have not been proven to be effective.

Patients who are considered for bariatric surgery must meet certain criteria, such as having a very high medical risk (BMI over 40 or a BMI between 35 and 39 with life-threatening or debilitating comorbid conditions like diabetes, dyslipidemia, hypertension, or cardiopulmonary disorders), being between 18 and 65 years old, having a history of obesity for at least 5 years, and having no history of alcoholism or major psychiatric disorders. For those who meet these

criteria, bariatric surgery can result in rapid and significant weight loss within the first year after the procedure.[16]

The goal of bariatric surgery is to produce a significant and meaningful reduction in weight that will lower the risk of obesity-related health problems. This reduction in weight, particularly in terms of visceral fat, has been linked to a range of benefits, including improved insulin sensitivity, decreased levels of interleukin-6 (IL-6), tumor necrosis factor-α (TNF-α), highly sensitive C-reactive protein levels (CRP), and increased levels of adiponectin. Additionally, loss of visceral fat can lead to a reduction in abdominal pressure, resulting in improvements in a variety of conditions, such as urinary incontinence and sleep apnea. Furthermore, the surgery has been shown to positively impact gut hormones involved in regulating glucose levels and appetite, as well as improve mechanical issues such as joint pressure and breathing. [11]

The novel surgical procedure of Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy (LPJB-SG) has become the leading bariatric surgery in terms of effectiveness for weight loss and remission of type 2 diabetes. The key to post-operative weight loss is the restriction of meal size and malabsorption of macronutrients. The focus of my study will be to examine the results of LPJB-SG, including weight loss, nutritional status, remission of type 2 diabetes, and enhancement of quality of life.

AIMS AND OBJECTIVES

To study the Outcomes of Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy (LPJB-SG) in terms of weight loss, Nutritional status and Remission of type II diabetes.

REVIEW OF LITERATURE

Overweight and obesity refer to an abnormal build-up of fat that affects one's health. Body Mass Index is a commonly used measure to categorize these conditions in adults. It is calculated by dividing a person's weight in kilograms by the square of their height in meters. In 2016, over 1.9 billion adults were overweight, with over 650 million classified as obese. 39% of adults (39% of men and 40% of women) globally were overweight, with 13% (11% of men and 15% of women) being obese, a threefold increase since 1975. The problem of overweight and obesity is no longer limited to high-income countries and is rapidly increasing in low and middle-income countries, especially in urban areas. In 2019, around 38.2 million children under 5 years of age were overweight or obese. An elevated body mass index is a significant contributing factor for several non-communicable diseases (NCDs) such as heart disease and stroke (which were the primary causes of death in 2012), diabetes, and osteoarthritis, a debilitating joint disease. Some cancers, including endometrial, breast, ovarian, prostate, liver, gallbladder, kidney, and colon, are also related to an increased risk of NCDs with a higher BMI.

Obese children are not only facing higher risks of obesity, premature death, and disability in adulthood but also suffer from various health problems such as breathing difficulties, increased risk of fractures, hypertension, early signs of cardiovascular disease, insulin resistance, and psychological issues. [1]

Epidemiology:

The World Health Organization (WHO) is currently facing a new pandemic in the form of obesity and its associated non-communicable diseases. WHO is concerned that the future burden of obesity and diabetes will greatly impact developing countries, with projections of hundreds of millions of new diabetes cases within the next 20 years. The pandemic is being spread through factors such as subsidized agriculture, multinational companies offering cheap, highly refined

foods, labour-saving machinery, affordable motorized transportation, and sedentary activities like watching television.[2]

Compared to Caucasians, Asians have a higher tendency to develop obesity at a higher Body Mass Index (BMI). Additionally, even at the same level of obesity, Asians have a higher risk of developing cardiovascular and metabolic disorders.[3]

There is a noticeable difference in the distribution of subcutaneous fat between Asians and whites, with Asians having more of this type of fat in their upper body. This disparity is more pronounced in females than in males. Additionally, Asians have a higher amount of subcutaneous fat than whites in general.[4,5]

Bariatric Surgery:

Bariatric surgery provides a solution for reducing weight and reversing the effects of obesity-related diseases, ultimately enhancing one's quality of life. [6] One of the most significant impacts of obesity is the development of atherosclerotic cardiovascular disease (ASCVD). [7]

For the majority of obese individuals with ASCVD, they typically have a combination of major and emerging risk factors known as metabolic syndrome. If an individual meets the criteria for metabolic syndrome as defined by the Adult Treatment Panel III, a 2-hour postprandial glucose test can help identify diabetes (when the 2-hour glucose level is ≥ 200 mg/dl) or impaired glucose tolerance (when the 2-hour glucose level is between 140-199 mg/dl). [1,8,9]

Measuring waist circumference is considered the most effective method to determine obesity in a clinical setting. [10]

Insulin resistance has been established as a significant threat to developing IGT and type 2 diabetes. [11,12]

The relationship between the brain and the body when it comes to appetite and eating habits has been understood since the era of Pavlov. [13]

The findings suggest that bariatric surgery can change the way the brain responds to food in terms of neural activation in the reward centers. This leads to a decreased sense of hunger and highlights the significance of understanding how bariatric surgery affects the

communication between the digestive system and the brain. This communication, referred to as the entero-encephalic endocrine axis, plays a crucial role in regulating hunger, nutrient intake, energy balance, and metabolism in humans. [14]

Pathophysiology:

The hormone Ghrelin, commonly known as the "hunger hormone," shows a drastic rise when a person is hungry or before a meal. However, this increase is temporary and decreases rapidly after the person has eaten. Ghrelin triggers the feeling of hunger by activating the NPY neurons which regulate appetite and metabolism. On the other hand, a sudden drop in the level of Ghrelin, which occurs after eating, leads to a sense of fullness or satiety. [15]

Treatment Options:

Two proven surgical options are available for the treatment of morbid obesity:

(1) Restrictive operations such as laparoscopic sleeve gastrectomy (LSG) or laparoscopic gastric banding (LGB)

(2) Gastric bypass operations such as Roux-en-Y gastric bypass (RYGB) or biliopancreatic diversion (BPD)

Other surgical options include intestinal bypass (effective but associated with major complications), jaw wiring (effective while used), and liposuction (cosmetic procedure). Gastric bubble and vagotomy have not been proved effective.

Surgical treatment of obesity may be considered only in carefully selected patients who meet the following criteria:

1) A very high medical risk exists (BMI >40 or BMI of 35 to 39 with life-threatening or disabling comorbid conditions such as diabetes mellitus, dyslipidemia, hypertension, or serious cardiopulmonary disorders)

(2) Obesity has been present for at least 5 years

(3) No history of alcoholism or a major psychiatric disorder is noted

(4) The patient is between 18 and 65 years of age. For such patients, a gastric surgical procedure can induce rapid and substantial weight reduction within 1 year postoperatively.[16]

History of Bariatric Surgery:

The first bariatric surgery performed was the jejunocolic bypass in 1954, followed closely by the jejunoileal bypass. This procedure involved connecting 14 (35.6 cm) inches of jejunum to 4 (10.2 cm) inches of ileum in either an end-to-end or end-to-side manner, effectively bypassing a significant portion of the small intestine. [17,18]

The jejunoileal bypass procedure, which was performed in the past, led to a significant reduction in weight but came with a significant risk of complications, including life-threatening conditions such as hepatic failure and cirrhosis, renal failure, oxalate nephropathy, immune complex disease, and nutritional deficiencies.[19] Due to these unfavourable outcomes, the procedure is no longer used. However, it is important for healthcare providers to be knowledgeable about this outdated procedure in case they encounter patients who have undergone it and require nutritional and metabolic management.

An alternative procedure, the Roux-en-Y anastomosis, was developed in the 1970s. This gastric bypass procedure was derived from gastrectomy procedures and was found to produce the same level of weight loss as the jejunoileal bypass but with much fewer complications. [20]

At present, there are three broad categories of bariatric procedures:

(i) Purely gastric restriction,

(ii) Gastric restriction with some malabsorption, as represented by the Roux-en-Y gastric bypass (RYGB), and

(iii) Gastric restriction with significant intestinal malabsorption [21]

The 1991 NIH Consensus Development Conference Panel [22,23] established the following general criteria for eligibility for bariatric surgery: patients with BMI ≥40 kg/m^2 could be considered surgical candidates; patients with less severe obesity (BMI ≥ 35 kg/m^2) could be considered if they had high-risk comorbid conditions such as life-threatening cardiopulmonary problems (for example, severe sleep apnea, Pickwickian syndrome, obesity-related cardiomyopathy or uncontrolled type 2 diabetes mellitus. Other possible indications for patients with BMIs between 35 and 40 kg/m^2 include obesity-

induced physical problems interfering with lifestyle (for example, joint disease treatable but for the obesity, or body size problems precluding or severely interfering with employment, family function, and ambulation.[22,23]

Objective of Bariatric Surgery:

The objective of bariatric surgery is to achieve substantial weight loss that will reduce obesity-related medical problems to a manageable level.[24-28] This loss of weight, specifically visceral fat, has been linked to numerous health benefits, such as improved insulin sensitivity, lower levels of certain inflammation markers, increased levels of the hormone adiponectin, and reduced intra-abdominal pressure.[29-35]

Additionally, bariatric surgery, particularly foregut bypass, has been shown to improve the hormone responses that regulate glucose and appetite, such as ghrelin, glucagon like peptide-1 (GLP-1), and peptide YY.[36,37] The procedure also brings about physical benefits, including less strain on joints, improved lung function, and relief from breathing and sleep apnea issues caused by excessive fat in the neck area.

Bariatric surgery has also been associated with a number of physiological changes, including diuresis, natriuresis, and reductions in blood volume and sympathetic activity, which can lower blood pressure. Other clinical benefits include improved T2DM, heart function, lipid profile, respiratory function, sleep patterns, joint health, infection rates, mobility, non-alcoholic fatty liver disease (NAFLD), asthma, polycystic ovary syndrome, fertility, and pregnancy outcomes.[38]

Finally, bariatric surgery has been found to significantly enhance patients' psychosocial wellbeing and quality of life after the procedure.[39-42]

Previous Studies:

The study on bariatric surgery for the treatment of morbid obesity introduced a new surgical procedure called Vertical Isolated Gastroplasty (VIG). From 2004 to 2005, 30 patients with a Body Mass Index (BMI) of 40 kg/m^2 or higher and co-morbidities underwent the VIG procedure through laparoscopy or laparotomy. The technique

involved the creation of a gastric tube, preserving the pylorus, and a Roux-limb connected to the bypassed stomach, which was divided 30 cm from the ligament of Treitz. The study assessed the patients' excess weight loss, BMI, complications, and co-morbidities. The results showed an average preoperative BMI of 41.2 kg/m^2 and weight of 110.7 kg, with a 12-month postoperative average BMI of 23.4 kg/m^2 and weight of 65.1 kg, and a 90.2% excess weight loss. There were no reported cases of dumping and improvement in co-morbidities was above 90%. The only complications recorded were sutureline dehiscence in one patient, hemoperitoneum in another, gastroenterostomy ulcer in a third, and anemia in a fourth. No mortality was recorded. This study showed that VIG is safe and effective, with results similar to other bariatric procedures, and has benefits such as no dumping and no significant stenosis of the gastroenterostomy. Additionally, VIG does not involve a duodenal bypass, allowing for normal iron absorption and access to the ampulla of Vater for diagnosis and treatment.[43,44]

LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY:

The Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy (LPJB-SG) procedure was first introduced by de Menezes in 2004 and has proven to be effective in weight loss and controlling the metabolic syndrome. This surgery combines a restrictive procedure with a 300 cm jejunal bypass and removal of the remnant stomach. Studies by de Menezes, Ettinger, and Alamo have demonstrated its success in a South American patient population.

In 2014 to 2016, a prospective cohort study was conducted by Chih-Kun Huang, Rajan Mahendra, Ming-Che Hsin, and Po-Chih Chan to evaluate the effectiveness of LPJB-SG. The study included patients with morbid obesity (BMI ≥32) and/or with uncontrolled type 2 diabetes mellitus (BMI >27). The patients excluded were those with pregnancy, suffering from psychiatric illnesses, or undergoing drug/alcohol abuse. The patients were evaluated by a multi-disciplinary team of medical

professionals, including a dietician, psychologist, psychiatrist, physical trainer, physiotherapist, and physicians.

The baseline measurements included height, body weight, BMI, blood studies, lipid profile, bone density measurement, and an upper gastro-intestinal scopy.

Surgical technique:

The surgery was performed under general anesthesia with the patient in a reverse Trendelenberg position. Four ports were utilized, either with a Veress needle or a bladeless optical trocar, for initial entry. A Fr 38 Oro-gastric tube was inserted and confirmed to be in place. The greater curvature of the stomach was devascularized starting from 4 cm from the pylorus using a 5mm Ligasure(Covidien™) vessel sealing device. All attachments, including the short gastric vessels, were released until the left crus was displayed. Gastrectomy was performed using a 38 Fr Oro-gastric tube and 60mm Endo GIA(Covidien™) black cartridges, starting distally on the stomach and followed by purple Tristapler reloads (Covidien™)proximally. The excised stomach specimen was removed at the end of the procedure. The ligament of Trietz was identified and the jejunum was divided at 20 cm with a white Endo GIA stapler cartridge (Covidien™). The distal jejunum was measured to a distance of 250 to 300 cm and was anastomosed to the proximal bilio-pancreatic jejunal limb using a white Endo GIA stapler reload(Covidien™). The enterotomy defect was closed with 3-0 poliglecaprone continuous sutures, and the mesentery defect was closed with 2-0 polyester sutures.

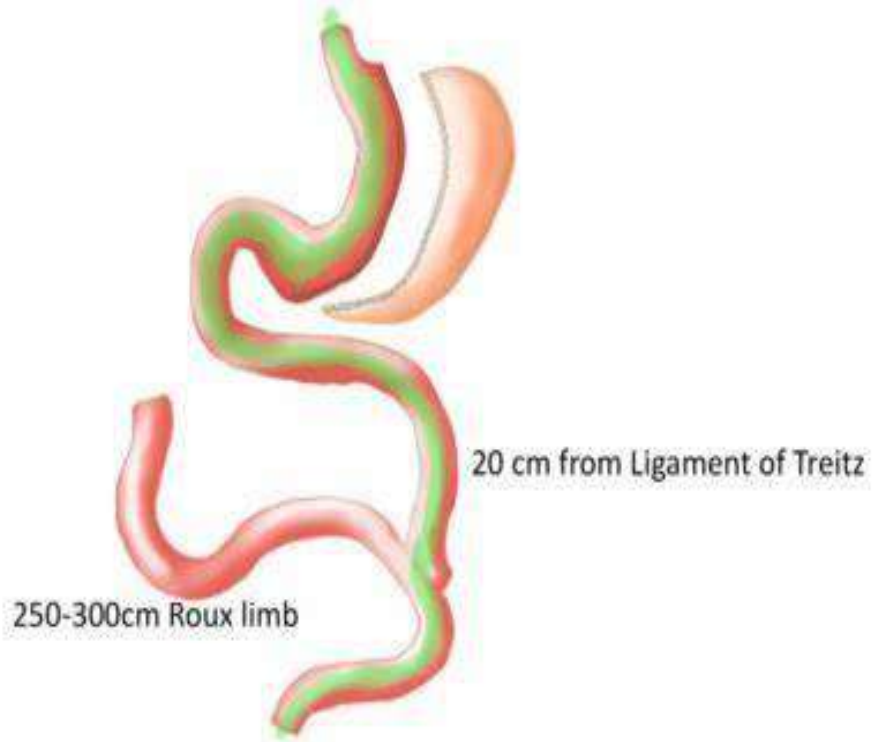


Figure A: Schematic figure of Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy

Throughout the study period, 65 patients were enrolled under LPJB-SG. Of these patients, 33 were females. The average age was 38.72, with a range of 19 to 71 years old. The mean Body Mass Index (BMI) was 45.32, ranging from 23.9 to 92.8. Out of the 65 patients, 37 were diagnosed with type 2 diabetes mellitus (T2DM). The average duration of having T2DM was 4.96 months, with a range of 1 to 15 months. The average HBA1C level was 8.26, with a range of 5.9 to 11.9. It is important to note that none of the patients were receiving insulin injections.

Table A: Patient characteristics and pre- surgical data

Characteristics	Number (N=65)/values	Range/% (SD)
Age (years)	38.72	19–71
Females	33	50.7%
BMI preoperative	45.3	27–92.8/11.74%
T2DM	37	56.9%
Duration T2DM (months)	4.96	1–15
HBA1c	8.26	5.9–11.9
Fasting sugar (mg/dL)	166.4	94–343/55.9%
C-peptide (ng/mL)	3.7	1.5–11.4 (SD: 2.01)
Hypertension	44	67.69%
Dyslipidaemia	56	86.15%
Fatty liver	63	96.92%

In the patient group, other co-occurring conditions were present, including hypertension in 44 individuals (67.69%), hyperlipidemia in 56 individuals (86.15%), and fatty liver in 63 individuals (96.92%). All surgical procedures were performed using laparoscopy, with an average operating time of 93.13 minutes (ranging from 41 to 180 minutes). The length of stay was approximately 2.2 days on average (with a range of 1 to 16 days).

There were no adverse incidents during or immediately after the surgery. The percentage of weight loss at 1, 3, and 6 months was 26.44%, 44.77%, and 65.87%, respectively. The average HBA1C levels dropped from 6.9 before the surgery to 6.04 at 6 months. For diabetic patients, at 1, 3, and 6 months, 11.53%, 60.86%, and 66.66% of patients achieved HBA1C levels below 6.0 and stopped taking diabetic medications. Additionally, 13.33% of patients had an HBA1C below 6.5 without oral hypoglycemic agents and another 13.33% showed improvement in their glucose levels while still on oral hypoglycemic agents.

There were three complications reported. One patient experienced dehydration and another patient experienced bleeding, which surprisingly occurred 47 days post-operation. Both incidents were managed with a brief hospitalization and conservative treatment. One

patient was diagnosed with gastric stenosis and underwent a successful conversion to laparoscopic Roux-en-Y bypass.

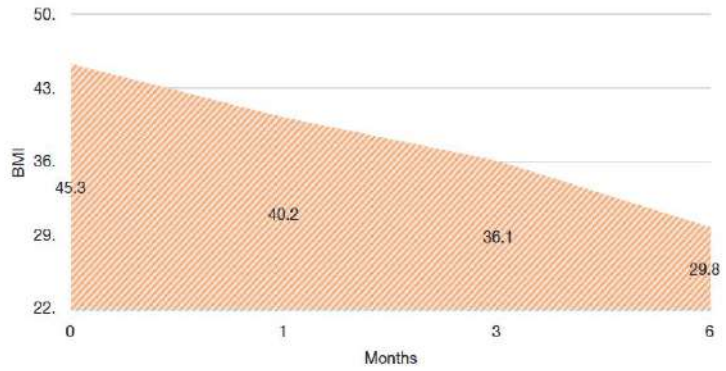


Figure B: BMI (mean) over 6 months post-operatively

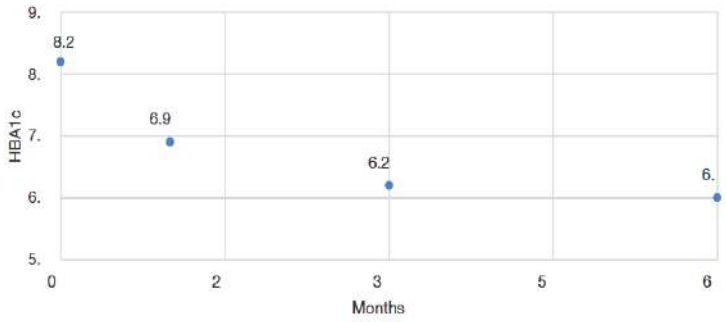


Figure C: HBA1c levels (mean) over 6 months post-operatively

Table B: Reduction in mean HBA1c and improvement in glycaemic status at 1, 3, and 6 months

Variable	1 month	3 months	6 months
HBA1C			
Mean	6.9	6.2	6.0
Range	5.3–9.2	5.2–9	4.8–8.2
HBA1c <6.0, not on OHA			
No.	3	14	10
Percentage	11.5%	60.8%	66.6%
HBA1c <6.5, not on OHA			
No.	5	6	2
Percentage	19.2%	26.0%	13.3%
HBA1c <7.0, on OHA			
No.	5	1	2
Percentage	19.2%	4.3%	13.3%

The bariatric field has evolved to focus primarily on two procedures: Laparoscopic Sleeve Gastrectomy (LSG) and Laparoscopic Roux-en-Y Gastric Bypass (LRYGB). These procedures have been developed based on extensive research and evidence, and have proven to be effective in reducing weight and managing co-existing health conditions. Of the two, Laparoscopic Gastric Bypass is considered to be the most successful, with a success rate of over 80% of patients experiencing a loss of 70% or more of their excess body weight within two years.[45]

The remission rate for diabetes is remarkably high, with 80% of patients experiencing complete resolution and an additional 15% showing substantial improvement. The global incidence of type 2 diabetes mellitus caused by obesity is on the rise. This literature review and meta-analysis aims to evaluate the impact of bariatric surgery on type 2 diabetes, taking into consideration the type of procedure performed and the amount of weight loss achieved. The review analyzed 621 studies and 135,246 patients, with 103 treatment arms reporting on the resolution of diabetes. Out of the 11,175 diabetic patients in 19 studies, the average age was 40.2 years, body mass index was 47.9 kg/m², 80% were female, and 10.5% had undergone previous bariatric procedures. On average, patients experienced a weight loss of 38.5 kg or 55.9% of their excess body weight. The results showed that 78.1% of diabetic patients had complete resolution and diabetes was improved or resolved in 86.6% of patients. The procedures that resulted in the greatest weight loss and diabetes resolution were biliopancreatic diversion/duodenal switch, followed by gastric bypass, and least by banding procedures. Insulin levels, HbA1c, and fasting glucose values all decreased significantly after surgery. There was little difference in weight and diabetes parameters between patients less than 2 years post-surgery and those who had undergone the procedure 2 years or more ago. The conclusion of the study is that bariatric surgery leads to the resolution or improvement of type 2 diabetes in the majority of patients and these positive effects are more

pronounced in procedures resulting in a higher percentage of excess body weight loss and can be sustained for 2 years or more.[46-49]

Recently, Laparoscopic Sleeve Gastrectomy (LSG) has emerged as an independent and effective procedure in the field of bariatric surgery. Its ease of use and wider adoption worldwide, combined with recent results showing its effectiveness compared to gastric bypass, make LSG a promising procedure. A study was conducted to compare the efficiency of LSG and LRYGB, with a hypothesis that LSG would result in a similar percentage excess body mass index loss after 5 years. The study, known as the Sleeve Bypass Trial, was a randomized clinical trial that enrolled 620 eligible patients who were equally divided into both treatment groups. Only experienced surgeons participated in the trial. The primary endpoint was to measure the 5-year weight loss of LSG and LRYGB, while secondary endpoints included resolution of obesity-related comorbidities, complications, revision bariatric surgeries, and quality of life (QOL). The results showed that LRYGB resulted in a higher percentage excess body mass index loss after 5 years compared to LSG, but more recent studies across the world have shown similar results for both techniques. Factors such as weight loss, resolution of comorbidities, and quality of life should be considered when deciding on the preferred surgical technique for certain subgroups in the future[50-51] despite some studies showing long-term diabetes remission rates being worse for LSG.[52]

LRYGP procedure has a higher frequency of immediate and long-term side effects, including anemia, marginal ulcers, dumping syndrome, and ongoing nutritional deficiencies. These complications necessitate a lifetime of nutritional supplementation and monitoring. Alternative malabsorptive procedures, such as Bilio-Pancreatic Diversion, although resulting in greater weight loss and improvement of co-morbidities, are associated with even more significant nutritional issues, bowel disturbances, and frequent hospital admissions. [53,54]

A study conducted by Alamo et al in 2012 analyzed 49 patients with type 2 diabetes mellitus (T2DM) and a body mass index (BMI) under 35. The results showed an impressive excess weight loss (EWL) of

76.1% at 18 months of follow-up, with 81.6% of patients experiencing complete remission of their diabetes and marked improvement in the rest. This study aimed to assess the efficacy of sleeve gastrectomy with jejunal bypass (SGJB) as a surgical treatment for T2DM in patients with a BMI below 35 kg/m². This study was a prospective cohort study, with patients who underwent SGJB between January 2009 and June 2011 at DIPRECA Hospital in Santiago and Hospital Base in Osorno, Chile included. SGJB involves creating a gastric tube and performing a jejunoileal anastomosis, preserving the pylorus. The mean age of the 49 patients who met the inclusion criteria was 49 years old, with 53% of them being female and a mean preoperative BMI of 31.6 kg/m². The operation time was 123 ± 14 minutes, with 94.7% being performed laparoscopically, and the mean postoperative hospital stay was 2 days. The median EWL at different postoperative months was 31.9% at 1 month, 56.9% at 3 months, 76.1% at 6 months, 81.5% at 12 months, and 76.1% at 18 months. Out of 49 patients, 81.6% achieved complete T2DM remission, and 18.4% had partial remission. 40 out of 41 patients on oral hypoglycemic agents had complete T2DM remission, and all insulin-dependent patients stopped using insulin but were still being treated for T2DM. Only one patient experienced postoperative gastrointestinal bleeding, and there were no deaths. SGJB was found to be an effective treatment for T2DM in patients with BMI under 35 kg/m², with no mortality and no detected nutritional deficiencies till the time of follow-up.[55]

PATHOPHYSIOLOGY OF LPJB-SG

The LPJB-SG subscribes to the commonly accepted theory of incretins in the treatment of diabetes. Early exposure of food to the ileum leads to an increase in the secretion of GLP-1 and Peptide YY by the L cells of the ileum, which has been shown to reduce the apoptosis of beta cells, increase insulin secretion, decrease the glucagon response and slow down gastric emptying. The incretin effect refers to the increase in insulin secretion after oral administration of glucose compared to intravenous administration at the same glucose levels. This effect is largely due to the release and action of the gut hormones glucose-

dependent insulinotropic polypeptide (GIP) and glucagon-like peptide-1 (GLP-1) on beta cells. In recent years, this system has garnered much interest due to the success of incretin therapy as a glucose-lowering strategy for type 2 diabetes. In healthy individuals, the incretin effect contributes to 50-70% of insulin release during oral glucose administration. However, in type 2 diabetes patients, the incretin effect is impaired and only accounts for 20-35% of the insulin response to oral glucose. The reasons for this defect have been extensively studied, with most studies showing fairly normal results for GIP and GLP-1 secretory responses to oral glucose or a mixed meal in type 2diabetes. On the other hand, the insulinotropic effects of both GIP and GLP-1 are impaired, with greater suppression of insulin secretion with GIP than with GLP-1. Possible causes include defective beta-cell receptor expression or post-receptor defects, defective beta-cell function, and genetic factors causing incretin hormone resistance. Understanding these mechanisms in greater detail is crucial for tailoring incretin therapy to individual patients and improving its efficacy in controlling diabetes. This, along with other factors, are responsible for the control of diabetes seen in similar intestinal bypass operations. The easiest way to achieve early exposure of food to the ileum is by bypassing the intervening jejunum by connecting the proximal jejunum to the ileum.[56-59]

The sleeve gastrectomy procedure is known to be effective in terms of weight loss and managing the metabolic syndrome. However, incorporating a malabsorptive component like a jejunal bypass could further improve the sustainability of weight loss and offer better control over diabetes. This additional benefit would make the surgery a practical option if the cost in terms of operation time or post-operative complications is minimal.

Given that the pylorus is intact and the common channel is longer, the risk of dumping syndrome and macro/micro nutrient malnutrition is believed to be reduced. However, the formation of a blind loop in the intestine may lead to bacterial overgrowth and blind loop syndrome. To date, no cases of bacterial overgrowth have been observed in follow-up

evaluations. Alamo et al. suggest that this is unlikely to occur as there is no food transit through the bypassed bowel that bacteria can use as a substrate and the iso-peristaltic orientation helps to prevent this occurrence.[55,60]

The human gut is home to a complex and diverse microbiome, which is characterized by its high population density and intricate interactions. Any disruption to this delicate balance, whether it be qualitative or quantitative, can result in serious health consequences such as small intestinal bacterial overgrowth syndrome (SIBO). This condition is defined as an increase in the number or alteration in the types of bacteria in the upper gastrointestinal tract. There are various inbuilt defence mechanisms to prevent bacterial overgrowth, including gastric acid secretion, intestinal motility, the intact ileo-caecal valve, immunoglobulins in intestinal secretion, and the bacteriostatic properties of pancreatic and biliary secretion. The cause of SIBO is often complex and can be associated with disorders of protective antibacterial mechanisms, anatomical abnormalities, and motility disorders. Symptoms of SIBO include bloating, diarrhoea, malabsorption, weight loss, and malnutrition. The gold standard for diagnosing SIBO is still through the investigation of jejunal aspirates, but non-invasive hydrogen and methane breath tests using glucose or lactulose are the most commonly used methods. Treatment for SIBO must be comprehensive and personalized, addressing underlying causes, symptoms, and complications. It should include the treatment of the underlying disease, nutritional support, and the use of selective antibiotics. The prognosis for SIBO is typically serious and depends largely on the underlying disease that led to its development. The fact that bowel anatomy can be easily reversed in the future is an important consideration for patients.

It is believed that the technical ease of the procedure, its ease of reproducibility, the reversibility of bowel anatomy, and comparable results will lead to wider adoption worldwide in the near future. The logical combination of the excellent weight loss results from sleeve gastrectomy with minimal malabsorption will play a crucial role in the

remission of diabetes. Long-term results and comparative studies with other surgeries are needed to validate this concept.

MATERIALS AND METHODS

SOURCE OF DATA

A Retrospective and Prospective study was carried out among patients admitted to the Department of General Surgery at Dayanand Medical College and Hospital in Ludhiana, covering the period from September 1st, 2020 to August 31st, 2022 (including follow-up). These patients underwent Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy (LPJB-SG) and were followed up for four months from the date of surgery. The details of each patient were recorded, including their name, age, gender, occupation, medical record number, and address for future reference.

METHOD OF COLLECTION OF DATA

Data was collected from each selected patient in the study through the use of pre-designed proforma. This included a comprehensive history, clinical examination, and complete investigational workup. A pre-operative consent was obtained from each patient prior to the study.

INCLUSION CRITERIA-

The inclusion criteria for the study involved

1. Patients who underwent Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy (LPJB-SG) as a treatment for obesity. The patients had a Body Mass Index (BMI) of over 32.5 and had previously failed medical therapy.
2. Additionally, the study included patients with morbid obesity, which was defined as those with a BMI of over 32 with or without diabetes.

EXCLUSION CRITERIA-

The exclusion criteria for patients in the study were as follows:

1. Individuals who were younger than 18 years old
2. Women who were pregnant
3. Those who suffered from a psychiatric illness
4. Individuals who had peptic ulcer disease
5. Patients who had advanced stages of malignancy.

METHOD OF COLLECTION OF DATA:

The study was conducted on patients who had initial measurements taken of their height, weight, Body Mass Index (BMI), waist circumference, hip/waist ratio, fasting blood sugar, 2-hour post prandial glucose, glycosylated haemoglobin, baseline blood studies, pulmonary, thyroid and liver function tests, blood pressure, lipid profile, and body fat composition analysis. This included analysis of the subcutaneous fat, skeletal muscle, skeletal muscle index, body fat percentage, visceral fat, resting metabolism, body age, and time in range by continuous glucose monitoring with a sensor. The body composition analysis was done through a body composition monitor (Omron HBF - 375 – IN) that depicted a personal number symbol for each patient.

These values were compared at the time of admission and 4 months post-operatively. The body composition analysis machine used bioelectric impedance analysis to determine the amount of fat-free mass and body fat in the patient's total weight. The continuous glucose monitoring sensor (FreeStyle Libre Sensor) was placed on the back of the patient's arm for 14 days and measured the amount of glucose in the patient's body fluid. The information was read with the help of a reader and displayed the sugar levels at intervals. If the blood sugar dropped to a dangerously low level or exceeded a high present level, the monitor would sound an alarm.

PRE- ANAESTHETIC CHECKUP

Before the surgery, a written informed consent was obtained from each patient. The day before the surgery, a comprehensive pre-anaesthetic evaluation was carried out, which included obtaining the patient's medical history, conducting a general physical examination, and performing relevant systemic examination. Standard tests such as a complete blood count, renal function test, pulmonary, thyroid and liver function tests, lipid profile, fasting blood sugar, 2-hour post-prandial glucose, glycosylated haemoglobin, and electrocardiogram were also conducted prior to the surgery.

PRE MEDICATION

Before their surgeries, all patients were required to fast for a minimum of 6 hours. The night prior to their operations, they were administered the following premedication.

They were given 0.25 mg of Alprazolam orally with a sip of water at night before the surgery and again at 6:00 am on the day of the operation. Additionally, they were given 150 mg of Ranitidine orally with a sip of water at night before the surgery and again at 6:00 am on the day of the operation.

METHODOLOGY

The team preoperatively evaluated each patient and provided a written, informed consent after thoroughly explaining the procedure. Routine preoperative investigations conducted included a haemoglobin test, random blood sugar test, renal function tests, prothrombin time test, chest X-ray, electrocardiogram, and any other necessary tests.

SAMPLE SIZE – Time Bound Study

FOLLOW – UP PERIOD – 4 months

DURATION OF STUDY – From 1st September 2020 to 31st August 2022 (Including followup)

OUTCOME

The research aimed to evaluate the impact of weight reduction, nutritional improvement, and remission of type II diabetes on the quality of life of the patients.

STATISTICAL ANALYSIS

The data was described in terms of range, mean +/- standard deviation, frequencies (number of cases), and relative frequencies (percentages) as appropriate. The comparison of quantitative variables was carried out using a paired t-test. The results were considered statistically significant if the probability value (p value) was less than 0.05. All statistical calculations were performed using SPSS (Statistical Package for the Social Science) version 21.

OBSERVATIONS AND RESULTS

The research was carried out in the Department of Surgery at Dayanand Medical College & Hospital, Ludhiana from September 1st, 2020 to August 31st, 2022, inclusive of a 4-month follow-up period. The study involved 40 patients who underwent LPJB with SG for treating morbid obesity at the DMCH. The findings of the study were recorded and presented in table form.

TABLE 1: DISTRIBUTION OF PATIENTS BASED ON AGE GROUP

Age Group (years)	No. of cases	Percentage
< 40	14	35.0%
41-50	12	30.0%
51-60	12	30.0%
61-70	2	5.0%
Total	40	100.0%

Out of 40 patients, majority of patients 35% (14) belong to age group <40 years. 30% (12) patients were in the age group of 41-50 years. 30% (12) patients were in the age group of 51-60 years. 5% (2) patients were in the age group of 61-70 years.

FIGURE 1: DISTRIBUTION OF PATIENTS BASED ON AGE GROUP

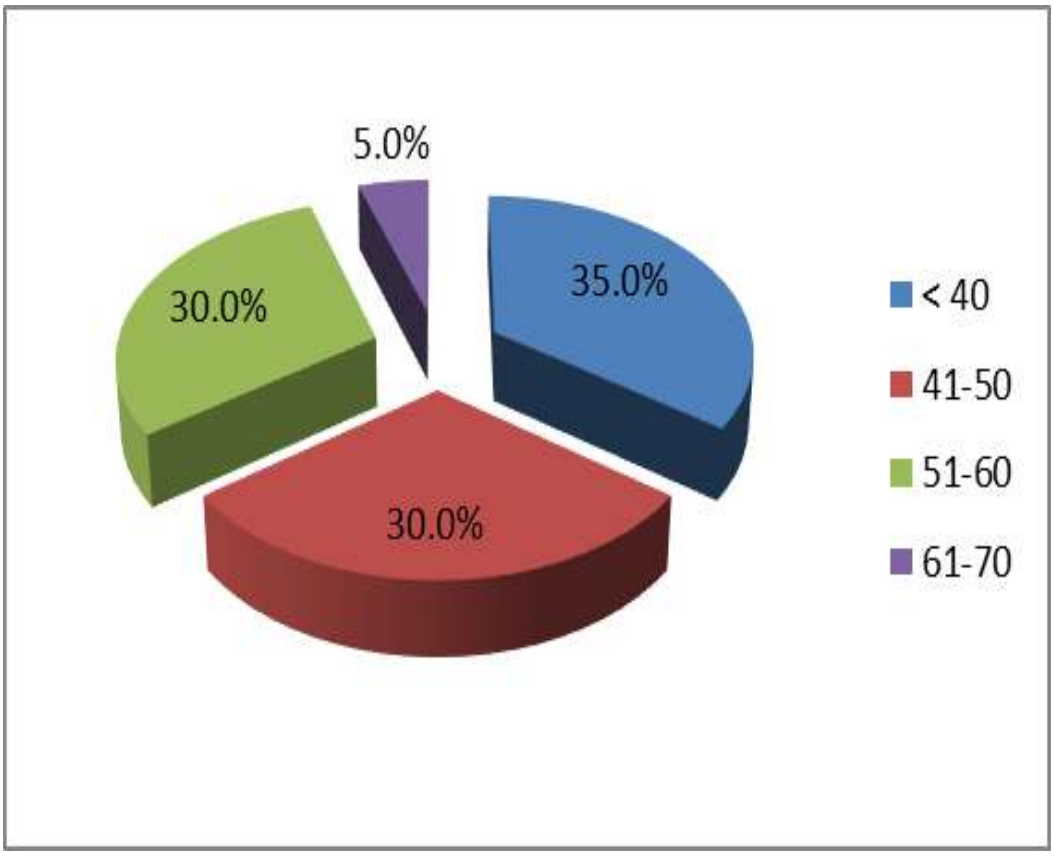


TABLE 2: DISTRIBUTION OF PATIENTS BASED ON SEX

Sex	No. of cases	Percentage
F	22	55.0%
M	18	45.0%
Total	40	100.0%

Out of 40 patients, 22 (55%) were females and 18 (45%) were males.

FIGURE 2: DISTRIBUTION OF PATIENTS BASED ON SEX

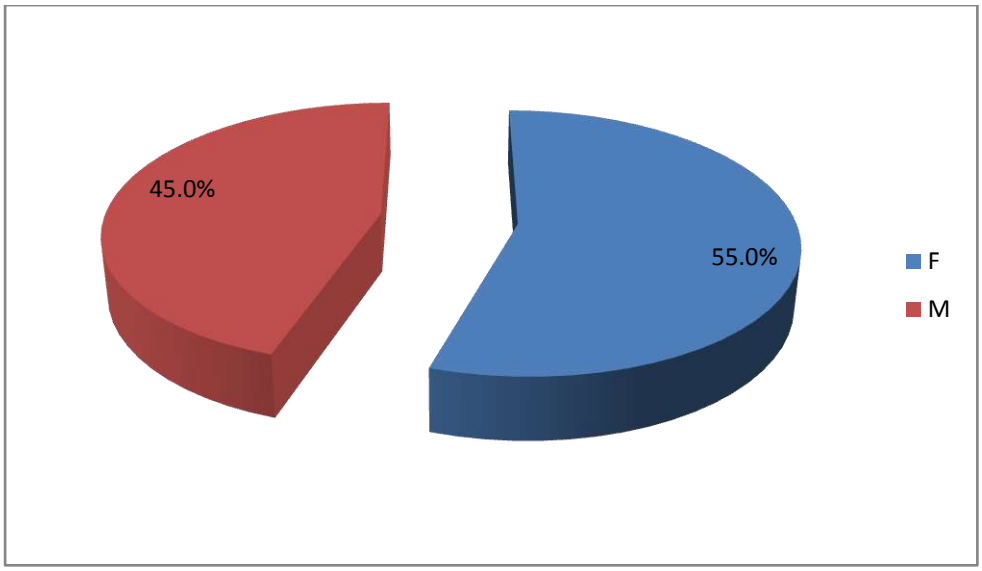


TABLE 3: DISTRIBUTION OF PATIENTS BASED ON MEDICAL TREATMENT FOR OBESITY

Medical treatment for obesity	No. of cases	Percentage
N	24	60.0%
Y	16	40.0%
Total	40	100.0%

Out of 40 patients, 24 (60%) had not taken any medical treatment for obesity and 16 (40%) had taken medical treatment for obesity.

FIGURE 3: DISTRIBUTION OF PATIENTS BASED ON MEDICAL TREATMENT FOR OBESITY

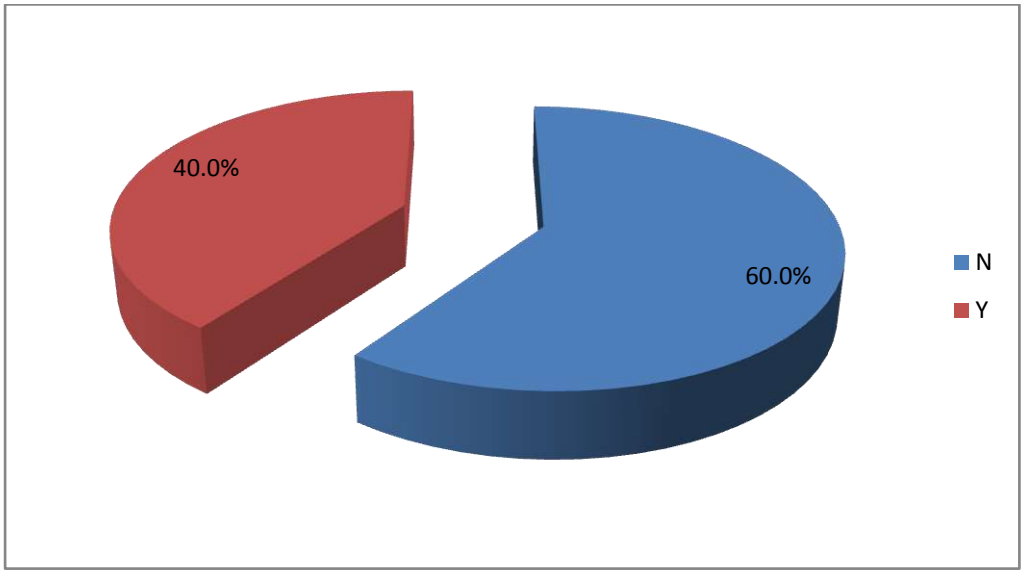


TABLE 4: DISTRIBUTION OF PATIENT BASED ON ANY OTHER THERAPY FOR OBESITY

Any other therapy for obesity	No. of cases	Percentage
None	40	100.0%

None of the 40 patients had taken any other therapy for obesity.

TABLE 5: DISTRIBUTION OF PATIENT BASED ON TYPE OF SURGERY PERFORMED

Type of Surgery performed	No. of cases	Percentage
LPJB-SG	40	100.0%

All 40 patients underwent Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy (LPJB-SG).

TABLE 6: DISTRIBUTION OF PATIENTS BASED ON CO-MORBIDITIES

Comorbidities	No. of cases	Percentage
DM-2	20	50.0%
DM-2,HTN	11	27.5%
DM-2,HTN,CAD	1	2.5%
DM-2,HTN,HTY	2	5.0%
DM-2,HTN,OSA	3	7.5%
DM-2,HTY,PCOD	1	2.5%
DM-2,OSA	1	2.5%
DM-2,PCOD	1	2.5%
Total	40	100.0%

Out of 40 patients, 20 (50%) had DM type II only , 11 (27.5%) had DM type II with hypertension, 1 (2.5%) had DM type II with hypertension with coronary artery disease, 2 (5.0%) had DM type II with hypertension with hypothyroidism, 3 (7.5%) had DM type II with hypertension with obstructive sleep apnoea, 1 (2.5%) had DM type II with hypertension with polycystic ovarian disease, 1 (2.5%) had DM type II with obstructive sleep apnoea and 1 (2.5%) had DM type II with polycystic ovarian disease.

FIGURE 4: DISTRIBUTION OF PATIENTS BASED ON CO-MORBIDITIES

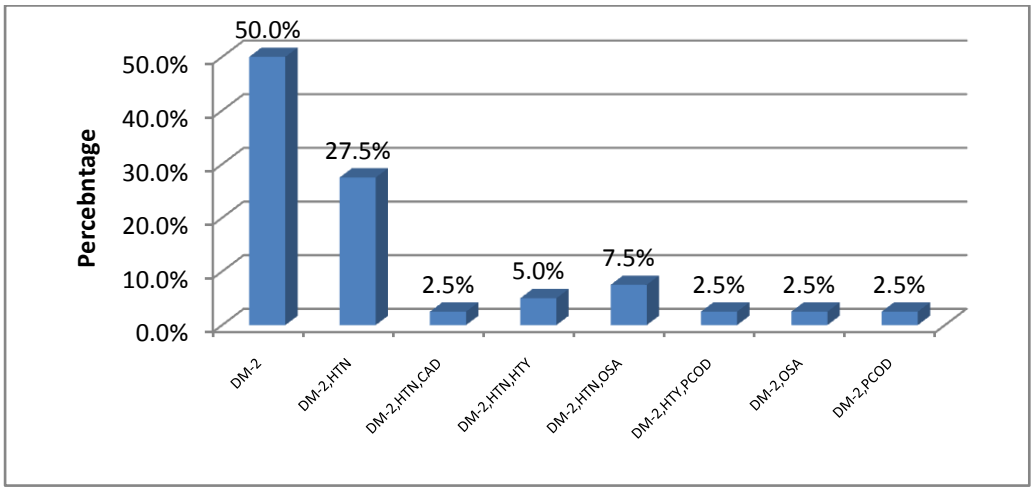


TABLE 7: EFFECT ON MEAN WEIGHT AND BODY MASS INDEX

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Weight (kg)	116.80	17.43	92.73	13.56	24.435	0.001	24.07	6.23
BMI (Kg/m2)	44.12	6.54	35.17	5.33	24.126	0.001	8.94	2.34

In this study, the effectiveness of weight loss surgeries was evaluated based on the changes in weight and Body Mass Index (BMI) before and after the surgery. The weight was recorded pre-operatively and after 4 months. The average weight before surgery was 116.80 ±17.43 kg. A remarkable reduction in weight was observed at 4 months with an average weight of 92.73 ± 13.56 kg, indicating that bariatric procedures effectively result in weight loss. The significance of this change was determined by a p-value of 0.001. The mean difference in weight at 4 months was 24.07 with a standard deviation of 6.23.

Additionally, there was a substantial decrease in the average BMI of the study group at 4 months following bariatric surgery, with a mean BMI of 35.17±5.33kg/m^2 compared to the pre-operative value of 44.12±6.54kg/m^2. The p-value of 0.001 was considered significant at 4 months. The mean difference in BMI at 4 months was found to be 8.94 with a standard deviation of 2.34.

Figure 5: EFFECT ON MEAN WEIGHT AND BODY MASS INDEX

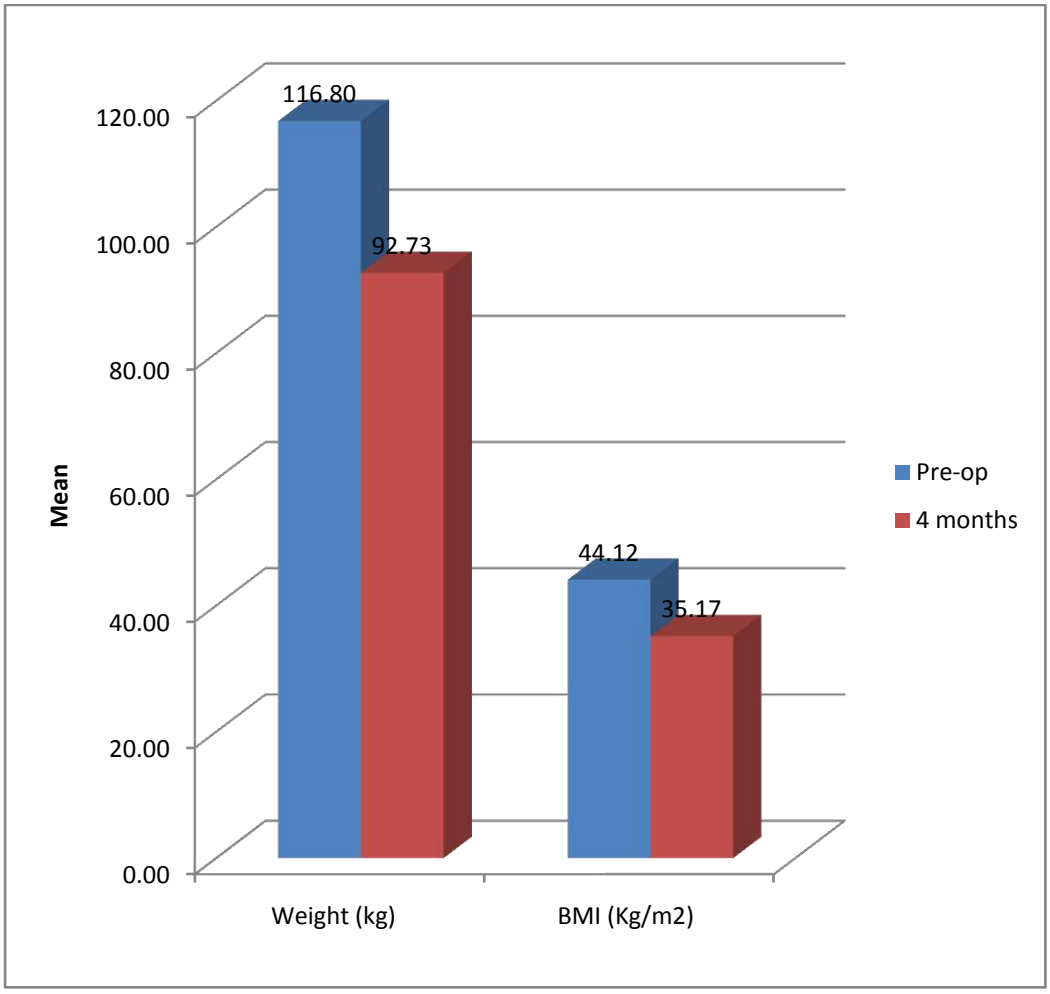


TABLE 8: MEAN PERCENTAGE EXCESS WEIGHT LOSS (%EWL)

Excess weight loss	No. of cases	Percentage
< 30	17	42.5%
31-40	20	50.0%
> 40	3	7.5%
Total	40	100.0%

Out of 40 patients, majority of patients –20 (50.0%) had excess weight loss in the range of 31-40%. 17 (42.5%) patients had excess weight loss of <30%. 3 (7.5%) patients had excess weight loss>40%.%EWL is defined as the percentage of excess body weight that is lost. It is calculated with the following formula

Excess weight loss % = $\frac{\text{Pre-op weight (kg) – Post-op weight (kg)}}{\text{Pre-op weight (kg) – Ideal weight (kg)}}$ x 100

Ideal weight was calculated after multiplying 24.9 (ideal BMI) with height (m^2).

FIGURE 6: MEAN PERCENTAGE EXCESS WEIGHT LOSS

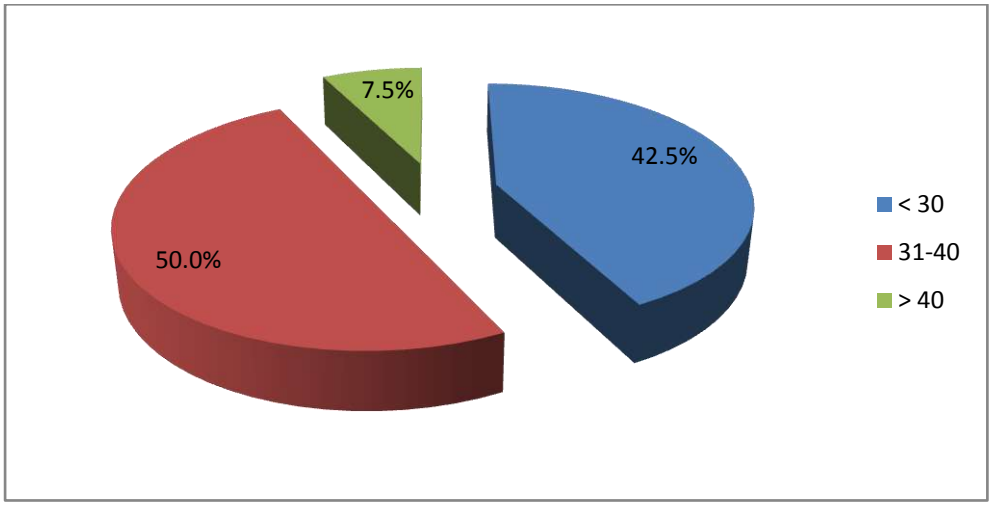


TABLE 9: DIFFERENCE BETWEEN EXCESS WEIGHT LOSS % PRE – OP AND AT 4 MONTHS

	N	Minimum	Maximum	Mean	Std. Deviation
Excess weight Loss%	40	19.23	44.13	31.87	5.88

In our study, there was a mean excess weight loss of 31.87 % at 4 months.

TABLE 10: EFFECT ON SYSTOLIC AND DIASTOLIC BLOOD PRESSURE

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
SBP (mmHg)	125.83	11.46	120.53	6.52	3.804	0.001	5.30	8.81
DBP (mmHg)	83.08	7.50	82.23	6.16	1.055	0.298	0.85	5.10

There was a significant decrease in SBP at 4 months following bariatric surgery in our study group with mean SBP at the end of 4 months being 120.53 ± 6.52 mmHg as compared to the pre-op values of 125.83 ± 11.46 mmHg. The p-value (0.001) was statistically significant at 4 months. The mean difference in SBP was found to be 5.30 at 4 months with a SD of 8.81.

There was not much decrease in DBP at 4 months following bariatric surgery in our study group with mean DBP at the end of 4 months being 82.23 ± 6.16 mmHg as compared to the pre-op values of 83.08 ± 7.50 mmHg. The p-value (0.001) was statistically insignificant at 4 months. The mean difference in DBP was found to be 0.85 at 4 months with a SD of 5.10.

FIGURE 7: EFFECT ON SYSTOLIC AND DIASTOLIC BLOOD PRESSURE

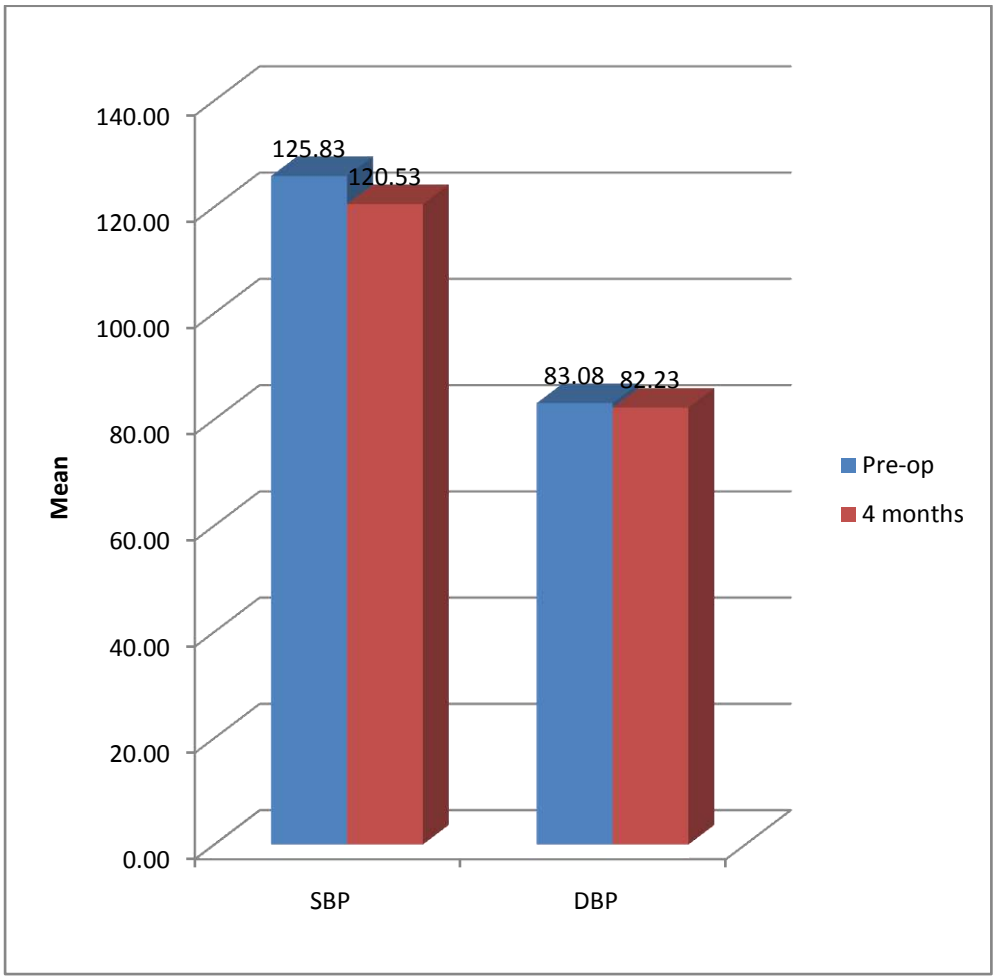


TABLE 11: EFFECT ON WAIST CIRCUMFERENCE AND HIP/WAIST RATIO

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Waist circumference (cm)	116.05	6.38	107.01	5.71	23.896	0.001	9.04	2.39
Hip/Waist Ratio	0.94	0.09	0.87	0.08	19.079	0.001	0.07	0.02

In our study, we observed a substantial reduction in waist circumference among the participants who underwent bariatric surgery after 4 months. The pre-operative values were recorded at 116.05 ±6.38 cm, but after 4 months, the mean waist circumference was 107.01cm with a standard deviation of 5.71. This change was statistically significant, as evidenced by a p-value of 0.001.

Additionally, there was a noticeable decrease in the hip/waist ratio among the participants in the study group after 4 months of bariatric surgery. The mean hip/waist ratio at the end of the 4-month period was recorded at 0.87, which was lower compared to the pre-operative value of 0.94. This change was also statistically significant, as indicated by a p-value of 0.001. The mean difference in hip/waist ratio was found to be 0.07 with a standard deviation of 0.02.

FIGURE 8: EFFECT ON WAIST CIRCUMFERENCE

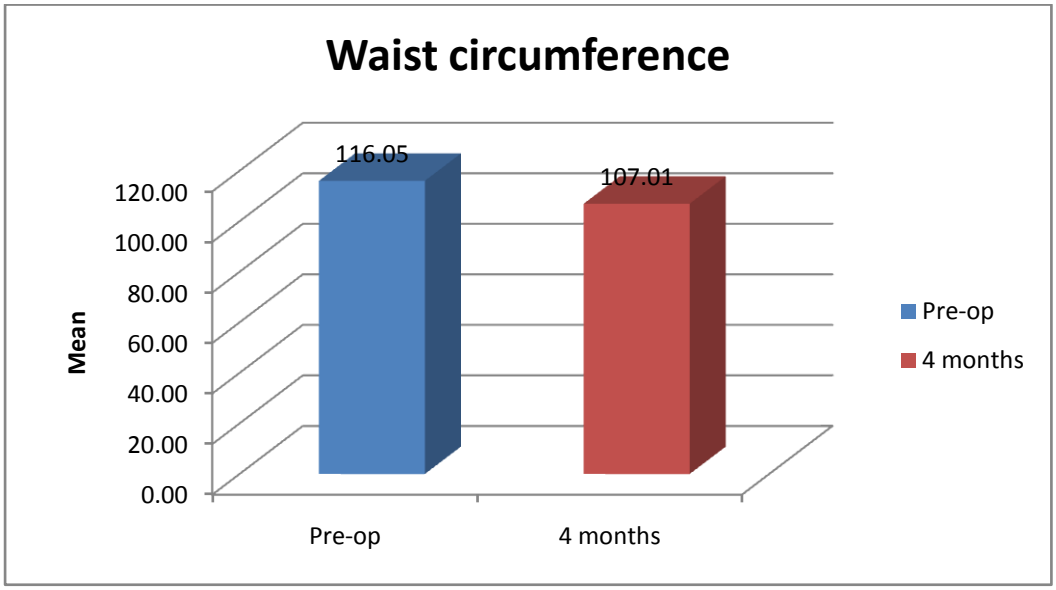


FIGURE 9: EFFECT ON HIP/WAIST RATIO

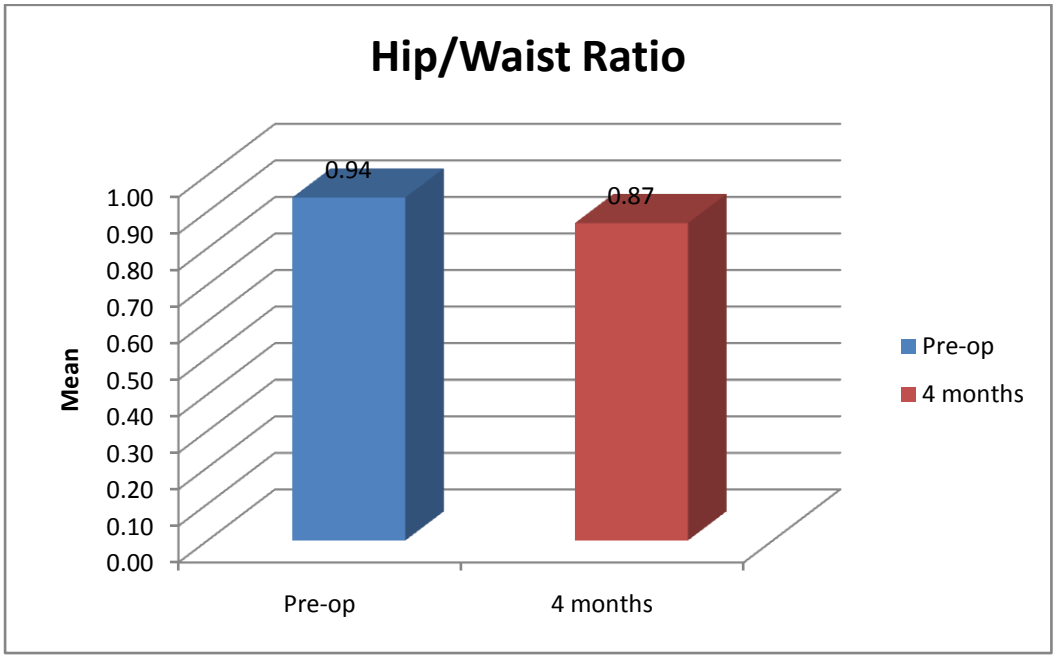


TABLE 12: EFFECT ON FASTING BLOOD SUGAR AND GLYCOSYLATED HEMOGLOBIN

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
FBS mg/dL	171.88	28.03	119.58	25.91	21.762	0.001	52.30	15.20
HBA1c (%)	7.85	1.28	6.98	1.07	14.022	0.001	0.88	0.39

In the study of 40 patients, the fasting plasma glucose levels were measured prior to the bariatric surgery and at 4 months post-surgery. The average fasting glucose level before the surgery was 171.88 mg/dL and after 4 months, it decreased to 119.58 mg/dL, which resulted in a mean difference of 52.30 with a standard deviation of 15.20. The follow-up results showed that the decrease was significant, as indicated by a significant p value. The decrease in fasting glucose levels was considerable when compared to the preoperative levels.

Furthermore, the study also measured the HbA1C levels of the patients. Before the surgery, the average HbA1C level was 7.85 ± 1.28%, and after 4 months, it significantly decreased to 6.98 ± 1.07% (p=0.001). The decrease in HbA1C levels indicated that the patients were gradually reaching non-diabetic levels of glycosylated hemoglobin. The mean difference was found to be 0.88 with a standard deviation of 0.39 after 4 months.

FIGURE 10: EFFECT ON FASTING BLOOD SUGAR

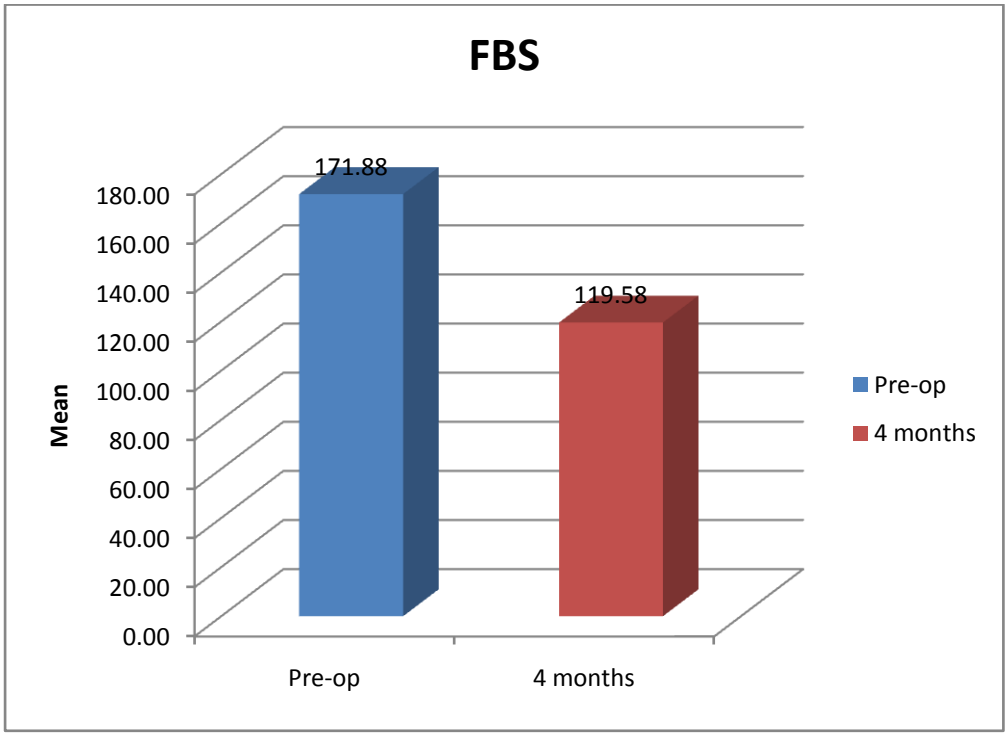


FIGURE 11: EFFECT ON GLYCOSYLATED HEMOGLOBIN

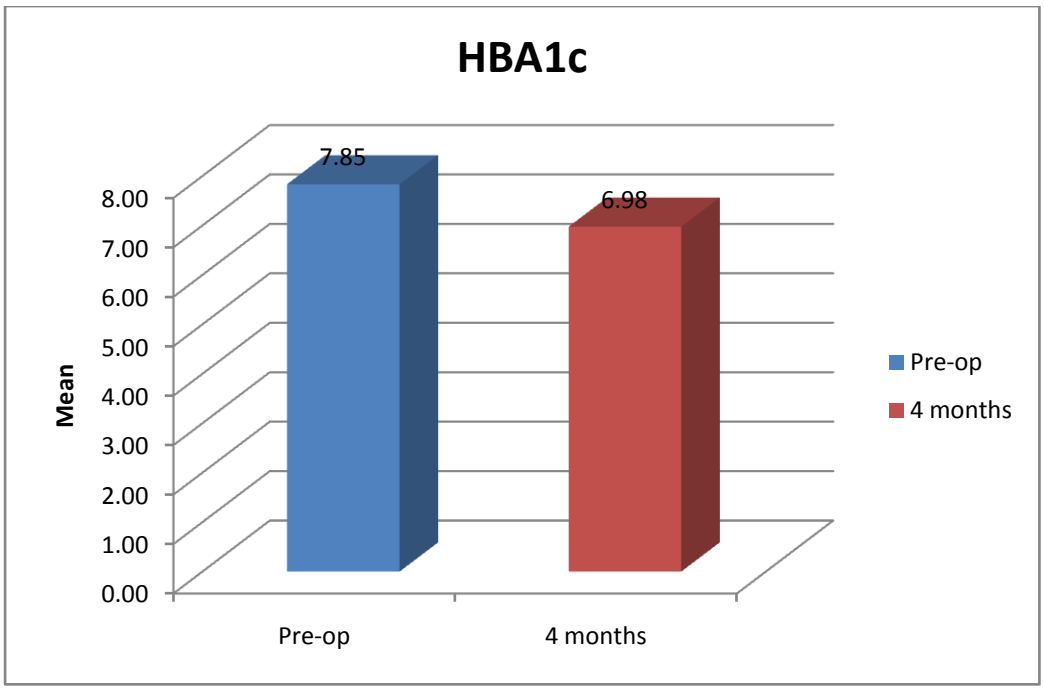


TABLE 13: EFFECT ON 2 HOUR POST PRANDIAL BLOOD SUGAR

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
2 HR-PP mg/dL	212.38	30.96	155.23	22.09	17.772	0.001	57.15	20.34

All patients underwent a preoperative check of their 2 hour post-meal blood glucose levels and another check was conducted 4 months after undergoing bariatric surgery. The average preoperative 2 hour post-meal blood glucose level was 212.38 mg/dL, which decreased to 155.23 mg/dL at the 4th month follow-up. The mean decrease in blood glucose levels was 57.15 mg/dL with a standard deviation of 20.34. The results were statistically significant as indicated by a significant p value. There was a noticeable reduction in blood glucose levels compared to the preoperative values.

FIGURE 12: EFFECT ON 2 HOUR POST PRANDIAL BLOOD SUGAR

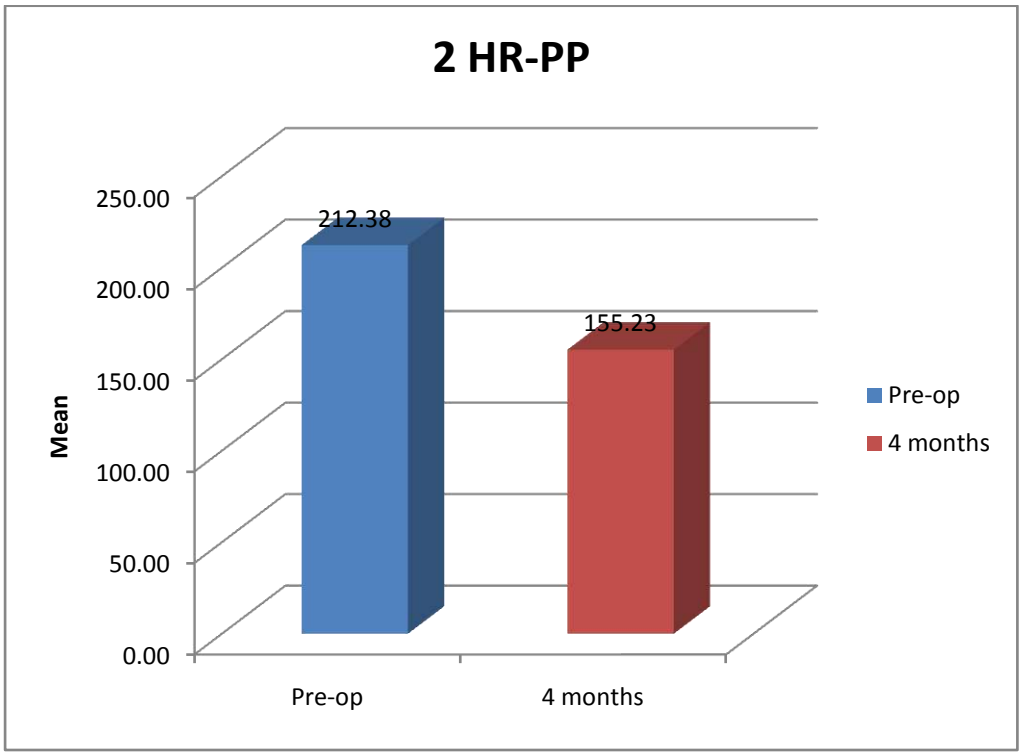


TABLE 14: EFFECT ON TRIGLYCERIDES, LDL, HDL

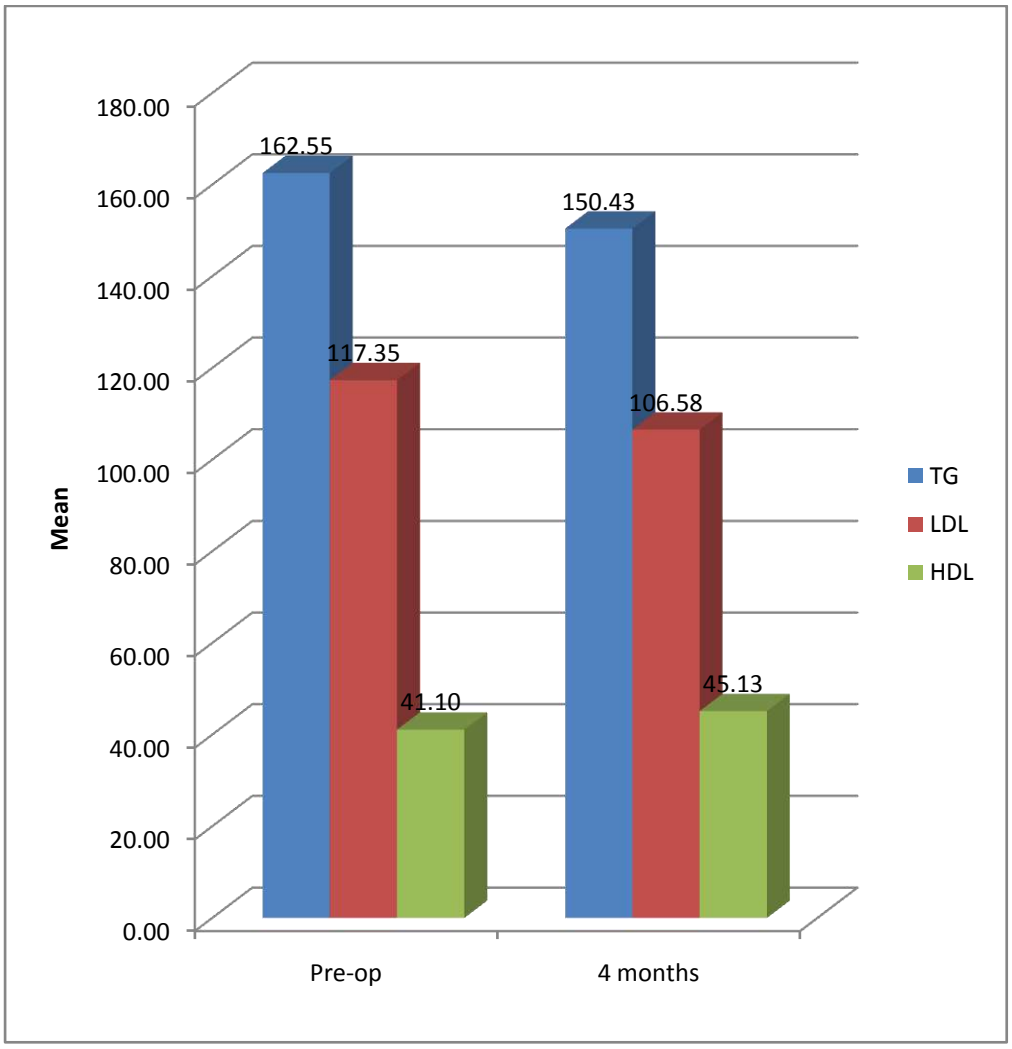
	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
TG (mg/dL)	162.55	15.99	150.43	13.69	12.680	0.001	12.13	6.05
LDL (mg/dL)	117.35	14.43	106.58	13.13	13.786	0.001	10.78	4.94
HDL (mg/dL)	41.10	7.30	45.13	5.85	-8.958	0.001	-4.03	2.84

Our study group underwent bariatric surgery and at 4 months post-surgery, there was a noticeable reduction in their triglyceride levels. The mean triglyceride level at the end of 4 months was 150.43 ± 13.69 mg/dL, which was lower compared to the pre-operative value of 162.55 ±15.99 mg/dL, with a significant p value of 0.001. The average difference at 4 months was 12.13 with a standard deviation of 6.05.

Similarly, the study group experienced a decline in their LDL levels 4 months after bariatric surgery. The mean LDL level at the end of 4 months was 106.58 ± 13.13 mg/dL which was lower than the pre-operative value of 117.35 ± 14.43 mg/dL with a significant p value of 0.001. The average difference at 4 months was 10.78, with a standard deviation of 4.94.

On the other hand, there was an increase in the HDL levels of the study group 4 months after bariatric surgery. The mean HDL level at the end of 4 months was 45.13 ± 5.85 mg/dL, which was higher compared to the pre-operative value of 41.10 ± 7.30 mg/dL with a significant p value of 0.001. The average difference at 4 months was -4.03, with a standard deviation of 2.84.

FIGURE 13: EFFECT ON TRIGLYCERIDES, LDL , HDL



PARAMETERS OBTAINED BY BODY COMPOSITION ANALYSIS MONITOR (OMRON HBF – 375- IN)

TABLE 15: EFFECT ON SUBCUTANEOUS FAT WHOLE BODY, TRUNK, ARMS AND LEGS

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Subcutaneous fat Whole body %	45.59	6.02	38.81	2.68	11.722	0.001	6.77	3.66
Trunk %	39.55	3.85	35.89	3.75	13.155	0.001	3.66	1.76
Arms %	58.04	4.56	54.82	3.43	11.089	0.001	3.22	1.84
Legs %	57.63	5.96	54.58	3.92	6.429	0.001	3.04	2.99

Our study group showed a decrease in subcutaneous fat levels throughout the body after 4 months of bariatric surgery. The average subcutaneous fat level at the end of 4 months was 38.81 ± 2.68 %, compared to the pre-operative levels of 45.59 ± 6.02 %, which was a significant difference with a p-value of 0.001. The mean decrease in subcutaneous fat levels was 6.77, with a standard deviation of 3.66.

Additionally, there was a decrease in subcutaneous fat levels in the trunk area after 4 months of bariatric surgery. The mean subcutaneous fat level in the trunk area was 35.89 ± 3.75 %, compared to the pre-operative levels of 39.55 ± 3.85 %, with a significant p-value of 0.001. The average decrease in subcutaneous fat levels was 3.66, with a standard deviation of 1.76.

Our study group showed a reduction in subcutaneous fat levels in the arms after 4 months of bariatric surgery. The mean subcutaneous fat in the arms was recorded at 54.82 ± 3.43 % after 4 months, which was lower than the pre-operative value of 58.04 ± 4.56 %. This decrease was found to be significant with a p-value of 0.001. The mean difference in the subcutaneous fat level at the end of 4 months was 3.22 with a standard deviation of 1.84.

Similarly, our study group also showed a decrease in subcutaneous fat levels in the legs after 4 months of bariatric surgery. The mean subcutaneous fat in the legs was recorded at 54.58 ± 3.92 % after 4 months, which was lower than the pre-operative value of 57.63 ± 5.96 %. This decrease was also found to be significant with a p-value of 0.001. The mean difference in the subcutaneous fat level at the end of 4 months was 3.04 with a standard deviation of 2.99.

FIGURE 14: EFFECT ON SUBCUTANEOUS FAT WHOLE BODY, TRUNK, ARMS AND LEGS

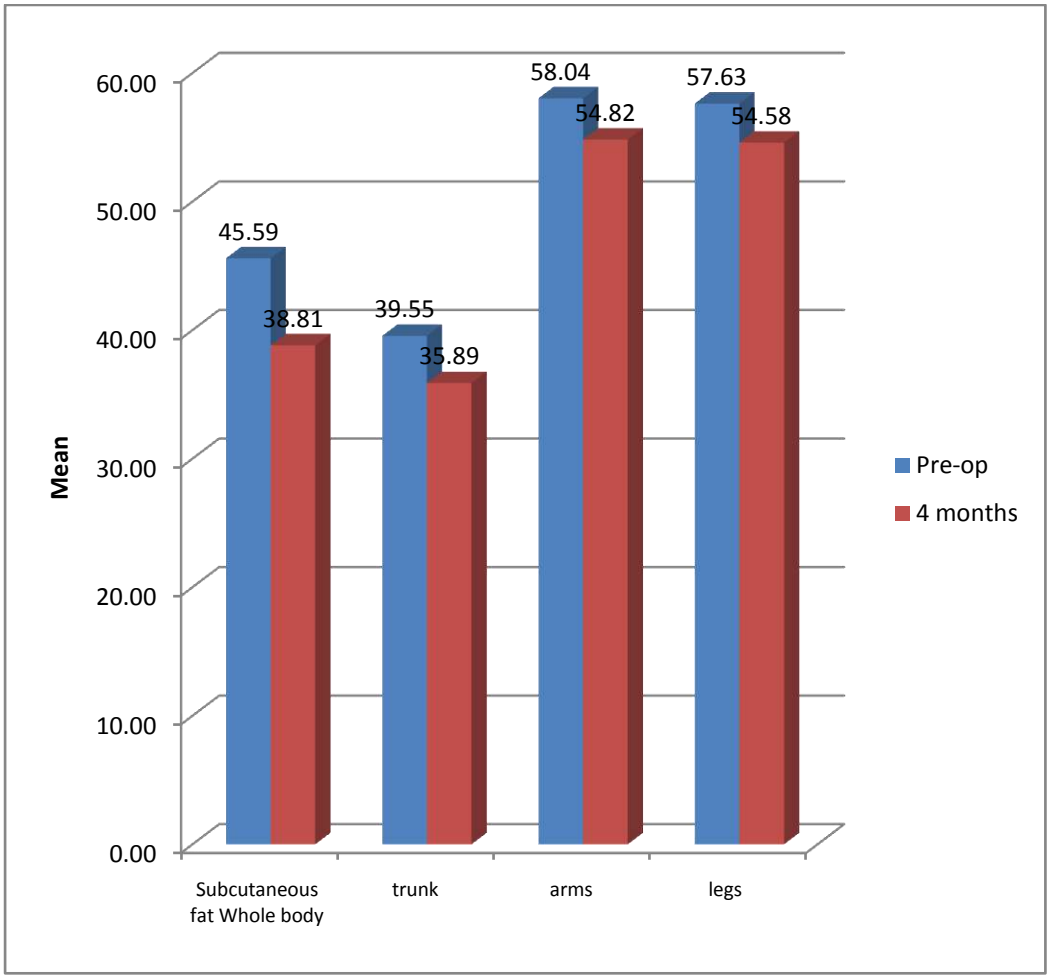


TABLE 16: EFFECT ON SKELETAL MUSCLE WHOLE BODY,TRUNK, ARMS AND LEGS AND SKELETAL MUSCLE INDEX

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Skeletal Muscle Whole body(kg)	25.59	4.24	21.47	2.12	6.303	0.001	4.12	4.13
Skeletal Muscle Trunk (kg)	16.41	5.11	13.62	1.24	3.549	0.001	2.80	4.98
Skeletal Muscle Arms (kg)	16.55	8.89	11.40	1.47	3.599	0.001	5.15	9.05
Skeletal Muscle Legs (kg)	40.63	4.55	34.87	4.83	7.185	0.001	5.76	5.07
Skeletal Muscle Index (kg/m2)	21.07	2.86	17.78	3.03	11.223	0.001	3.30	1.86

Our study group underwent bariatric surgery and at the end of 4 months, there was a significant decrease in the levels of whole body skeletal muscle, with the mean values reducing from 25.59 ± 4.24 kg to 21.47 ± 2.12 kg, as indicated by the significant p value of 0.001. The mean difference of 4.12, with a standard deviation of 4.13, was observed at 4 months post-surgery.
Furthermore, there was a decrease in the levels of skeletal muscle in the trunk area, with the mean values dropping from 16.41 ± 5.11 kg to 13.62 ± 1.24 kg, as reflected by the significant p value of 0.001. The mean difference of 2.80, with a standard deviation of 4.98, was noted at 4 months post-surgery.

In our study group, a decline in the levels of skeletal muscle in the arms was observed 4 months after undergoing bariatric surgery. The average skeletal muscle arm level at the end of 4 months was 11.40 ± 1.47 kg, which was significantly lower than the pre-operative level of 16.55 ± 8.89 kg with a p value of 0.001. The mean difference after 4 months was 5.15 with a standard deviation of 9.05.

Similarly, there was a decrease in the levels of skeletal muscle in the legs in the study group 4 months after bariatric surgery. The mean skeletal muscle leg level at the end of 4 months was 34.87 ± 4.83 kg, compared to the pre-operative value of 40.63 ± 4.55 kg, with a significant p value of 0.001. The mean difference at 4 months was 5.76 with a standard deviation of 5.07.

The skeletal muscle index is the ratio of skeletal muscle mass in arms and legs to height and an indicator of sarcopenia. Additionally, the skeletal muscle index in the study group also decreased 4 months after bariatric surgery. The average skeletal muscle index at the end of 4 months was 17.78 ± 3.03 kg/m^2, which was lower than the pre-operative level of 21.07 ± 2.86 kg/m^2, with a significant p value of 0.001. The mean difference after 4 months was 3.30 with a standard deviation of 1.86.

FIGURE 15: EFFECT ON SKELETAL MUSCLE WHOLE BODY, TRUNK, ARMS AND LEGS

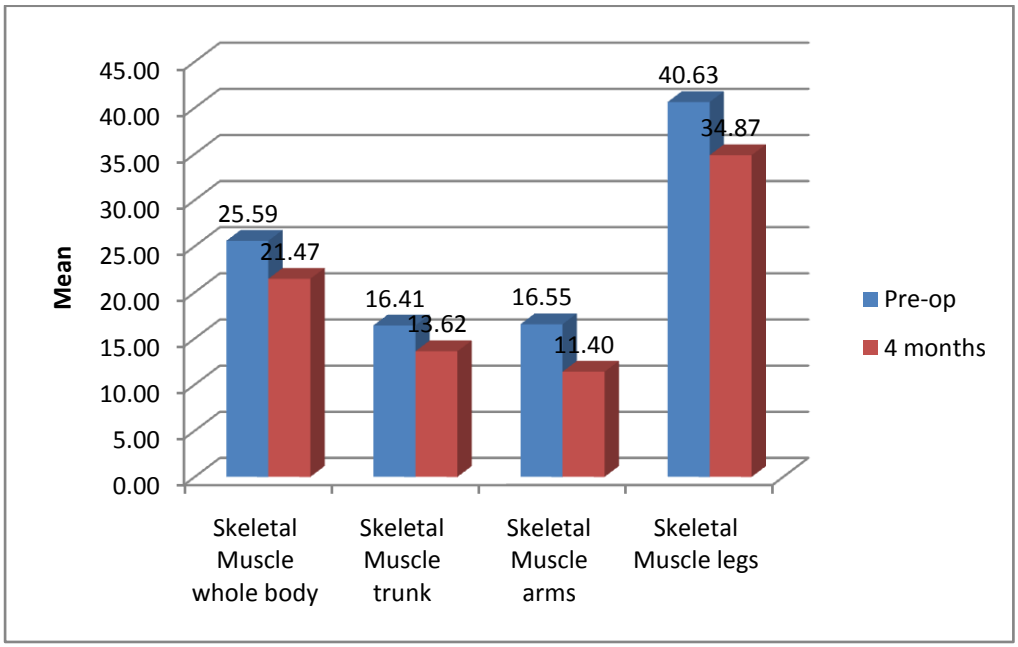


FIGURE 16: EFFECT ON SKELETAL MUSCLE INDEX

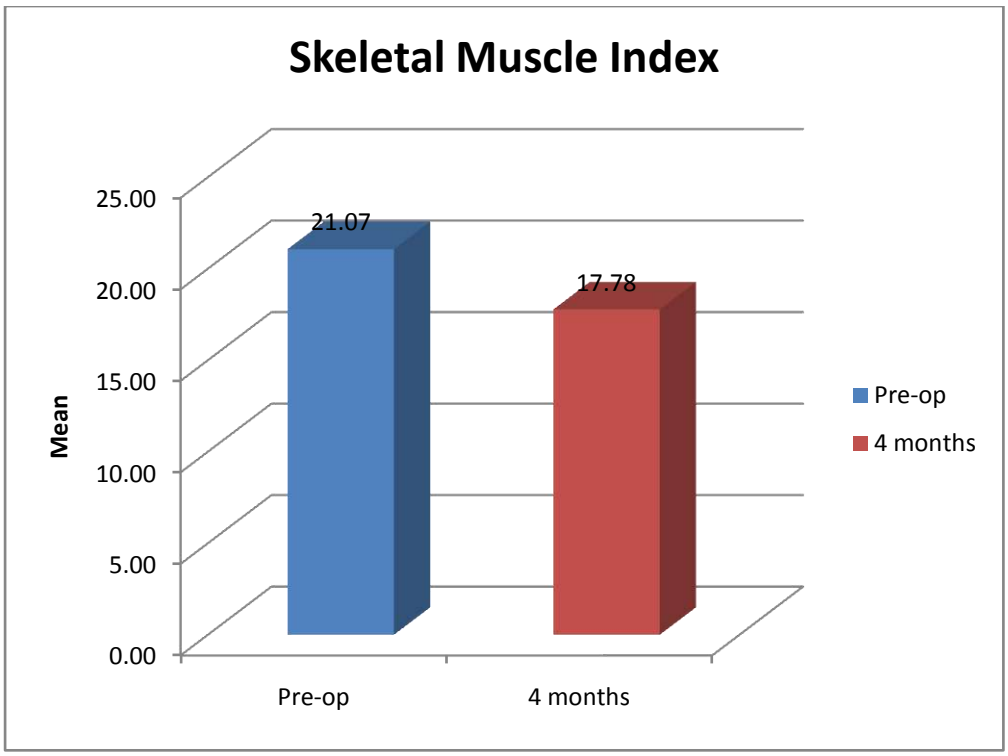


TABLE 17: EFFECT ON BODY FAT PERCENTAGE

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Body fat percentage (%)	45.22	4.48	42.00	1.51	5.452	0.001	3.22	3.74

In our study group, a decrease in body fat percentage was observed four months after bariatric surgery. The mean body fat percentage at the end of four months was 42.00 ± 1.51 %, which was lower compared to the pre-operative values of 45.22 ± 4.48 %, and the results were statistically significant (p-value = 0.001). The mean difference in body fat percentage at four months was 3.22 with a standard deviation of 3.74.

FIGURE 17: EFFECT ON BODY FAT PERCENTAGE

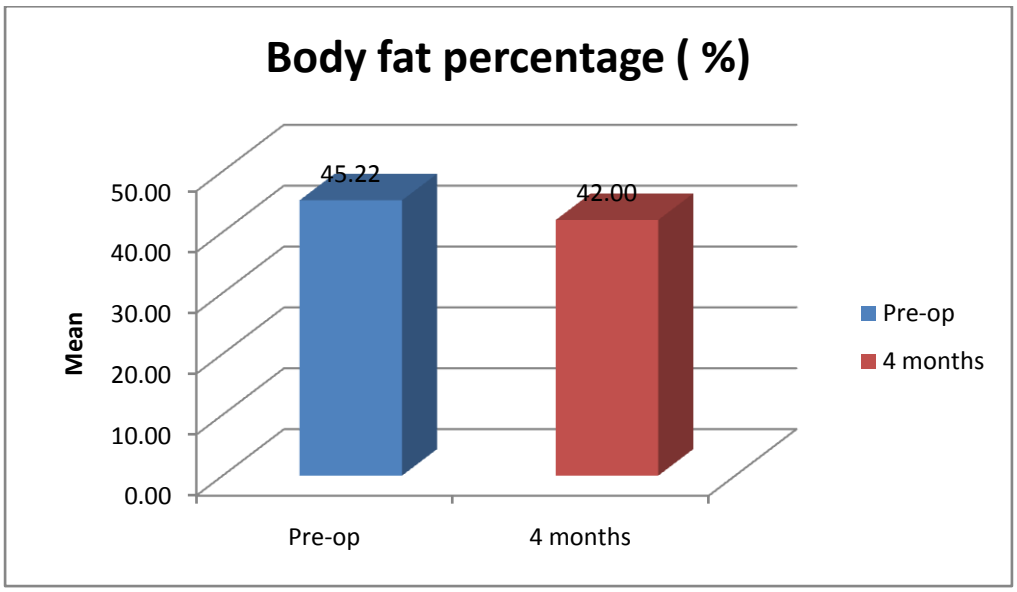


TABLE 18: EFFECT ON VISCERAL FAT

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Visceral fat (%)	24.11	5.22	17.53	4.28	27.856	0.001	6.59	1.50

There was a decrease in visceral fat percentage at 4 months following bariatric surgery in our study group with the mean visceral fat percentage at the end of 4 months being 17.53 ± 4.28 % as compared to the pre-op values of 24.11 ± 5.22 % with significant p value (0.001). The mean difference at 4 months being 6.59 with SD of 1.50.

FIGURE 18: EFFECT ON VISCERAL FAT

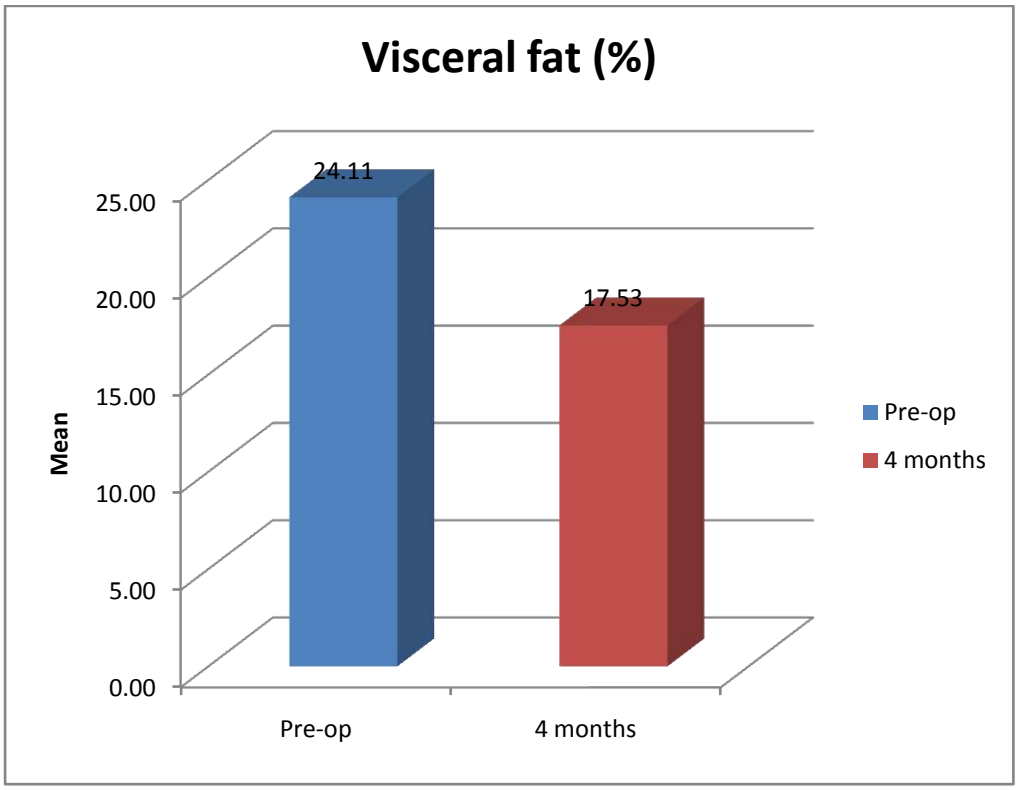


TABLE 19: EFFECT ON RESTING METABOLISM

	Pre-op		4 months		t	p-value	Difference	
	Mean	**SD**	**Mean**	**SD**			**Mean**	**SD**
Resting Metabolism (kcal)	2126.18	491.13	1547.68	228.56	9.708	0.001	578.50	376.89

We observed a decrease in resting metabolism four months after bariatric surgery. The mean resting metabolism at the end of four months was 1547.68 ± 228.56 kcal, which was significantly lower compared to the pre-operative values of 2126.18 ± 491.13 kcal (p value 0.001).The mean difference at four months was 578.50 with a standard deviation of 376.89.

FIGURE 19: EFFECT ON RESTING METABOLISM

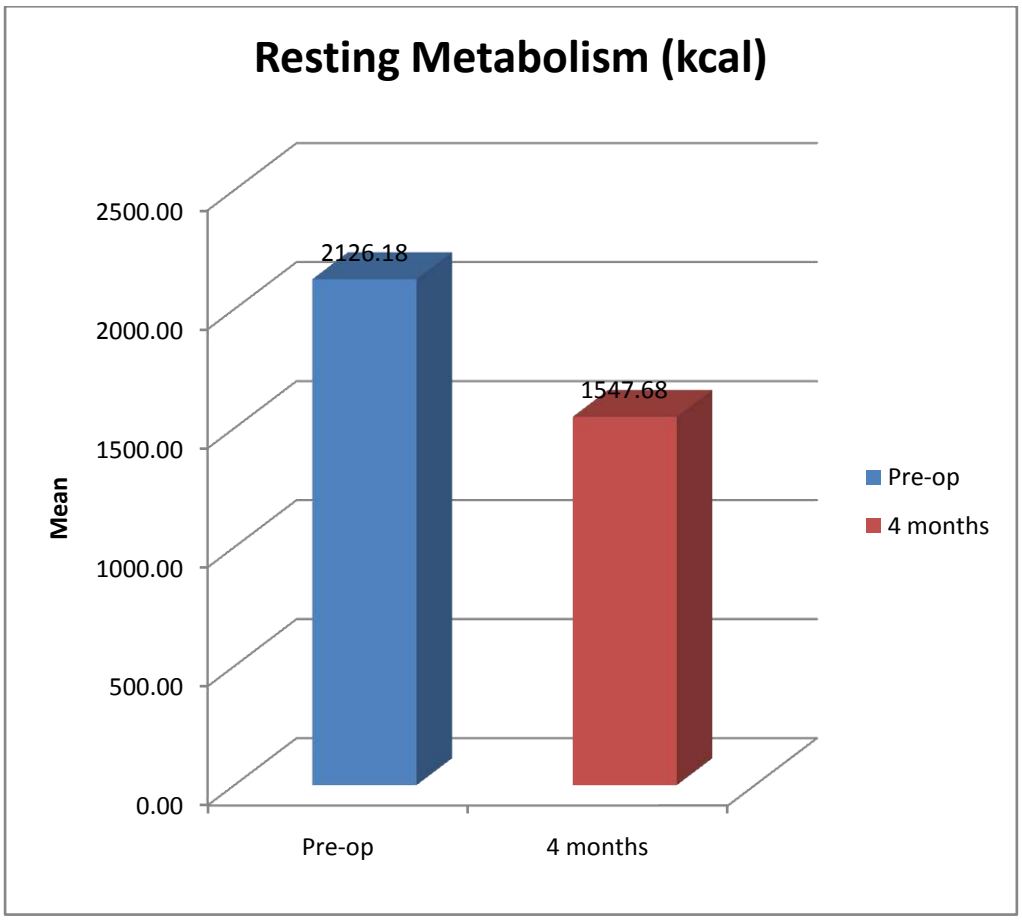


TABLE 20: EFFECT ON BODY AGE

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Body age	75.90	6.54	66.03	4.08	22.733	0.001	9.88	2.75

In our study group, the body age decreased by 4 months following bariatric surgery. The mean body age at the end of the 4 months was 66.03±4.08, which was significantly lower than the pre-operative value of 75.90±6.54 (p value = 0.001). The mean difference in body age between pre- and post-operation was 9.88, with a standard deviation of 2.75.

FIGURE 20: EFFECT ON BODY AGE

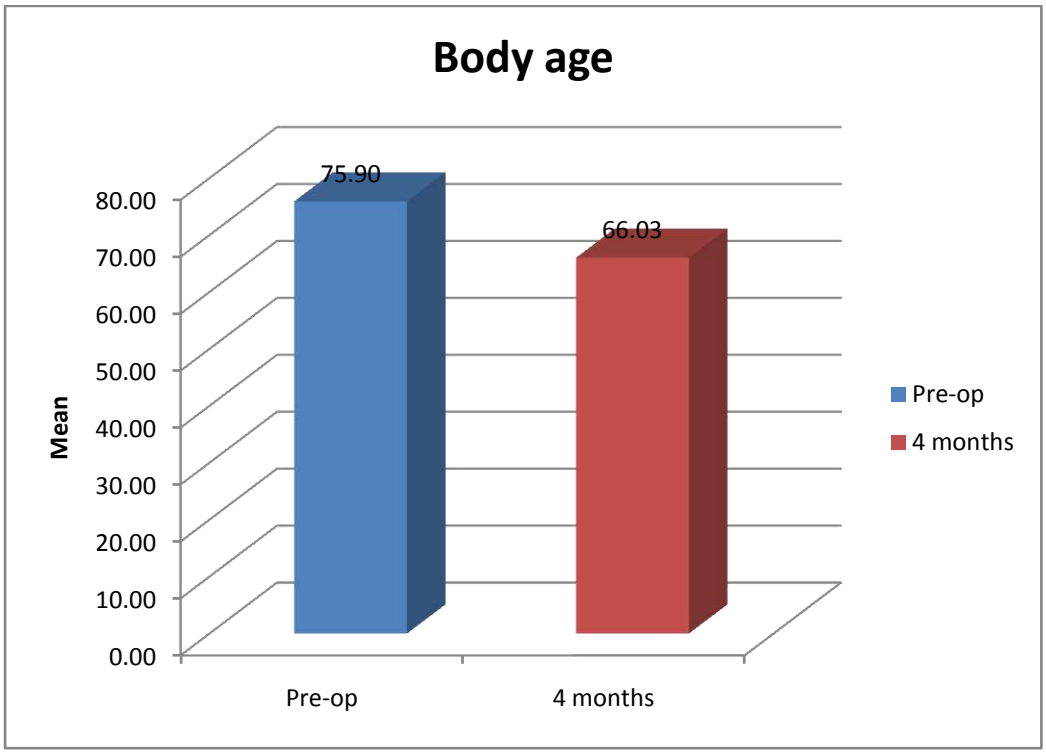


TABLE 21: EFFECT ON TIME IN RANGE % (ASSESSED BY CONTINUOUS GLUCOSE MONITORING SENSOR)

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Time in range (%)	53.87	18.38	66.77	14.00	-10.374	0.001	-12.90	6.93

There was a significant increase in the time in range 4 months post-bariatric surgery, with a mean time in range of 66.77 ± 14.00%, as compared to the pre-operative value of 53.87 ± 18.38%. The p-value was found to be highly significant (0.001). The mean difference in time in range at 4 months was calculated to be -12.90, with a standard deviation of 6.93.

FIGURE 21: EFFECT ON TIME IN RANGE

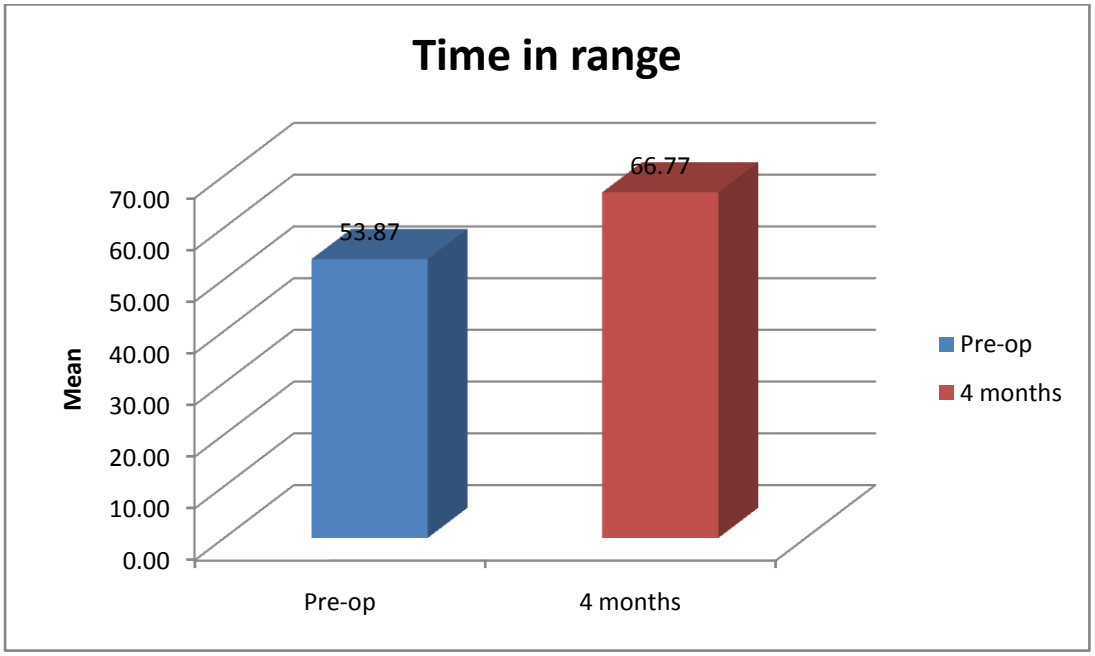
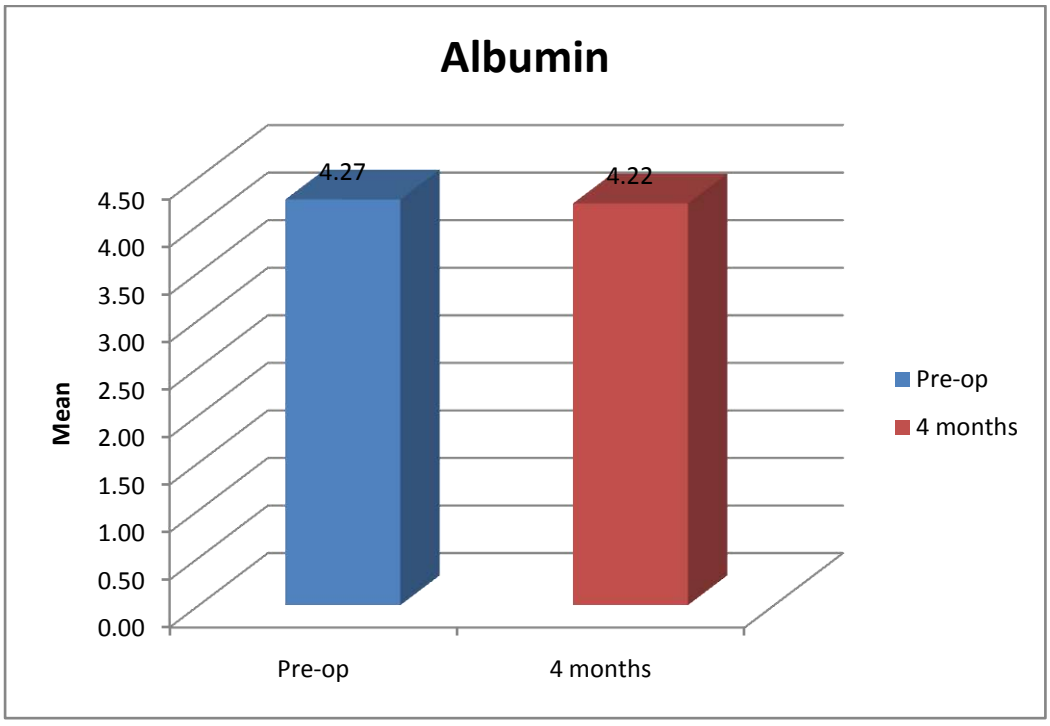


TABLE 22: EFFECT ON ALBUMIN

	Pre-op		4 months		t	p-value	Difference	
	Mean	SD	Mean	SD			Mean	SD
Albumin (g/dL)	4.27	0.44	4.22	0.33	1.177	0.246	0.04	0.23

In our study group, the level of serum albumin after 4 months of bariatric surgery was found to be almost similar with a mean albumin level of 4.22 ± 0.33 g/dL at the end of 4 months, compared to the pre-operative value of 4.27 ± 0.44 g/dL. The p value of 0.246 indicated an insignificant difference. The mean difference between the pre-operative and post-operative levels was 0.04 with a standard deviation of 0.23.

FIGURE 22: EFFECT ON ALBUMIN



DISCUSSION

The study was conducted in the Department of Surgery at Dayanand Medical College & Hospital, Ludhiana from September 1st, 2020 to August 31st, 2022, including a 4-month follow-up period. It included 40 patients who underwent surgery for morbid obesity at DMCH. The following data was recorded and compared pre-operatively and 4 months post-operatively: weight, height, BMI, waist circumference, hip/waist ratio, fasting blood sugar, 2-hour post-prandial glucose, glycosylated hemoglobin, lipid profile, blood pressure, body composition analysis monitor (Omron HBF-375–IN) to calculate subcutaneous fat, skeletal muscle, skeletal muscle index, body fat percentage, visceral fat, resting metabolism, body age) serum albumin, and time in range using a continuous glucose monitoring sensor (FreeStyle Libre Sensor)

EFFECT OF BARIATRIC SURGERY ON WEIGHT LOSS AND BMI

The effectiveness of weight-loss surgeries was determined by evaluating the change in weight and Body Mass Index (BMI) before and after the procedure. Weight was recorded prior to surgery and four months after. The average weight before surgery was 116.80 ± 17.43 kg. There was a significant reduction in weight four months after surgery with an average weight of 92.73 ± 13.56 kg, indicating that bariatric surgery leads to successful weight loss. All patients who underwent laparoscopic proximal jejunal bypass with sleeve gastrectomy experienced weight loss with a mean percent excess weight loss (%EWL) of 31.87 % at four months.

Research conducted by Chih-Kun Huang, Rajan Mahendra, Ming-Che Hsin, and Po-Chih Chan involved 65 patients who underwent LPJB-SG from October 30th, 2014 to April 15th, 2016. The results showed a gradual increase in excess weight loss percentage, which was 26.44% at 1 month, 44.77% at 3 months, and 65.87% at 6 months. [45]

In another study, Alamo et al. published their findings in 2012, which involved 49 patients who underwent SGJB at DIPRECA Hospital in Santiago and Hospital Base in Osorno, Chile between January 2009 and June 2011. The results showed that the excess weight loss at 1, 3, 6, 12, and 18 months postoperatively was 31.9%, 56.9%, 76.1%, 81.5%, and 76.1% respectively. [55]

In our research, there was a noticeable reduction in the Body Mass Index (BMI) of the study group at four months post-bariatric surgery, with an average BMI of 35.17 ± 5.33 kg/m^2 recorded at the end of the fourth month, which was in contrast to the pre-operative values of 44.12 ± 6.54 kg/m^2.

The results published by Alamo et al. in 2012, involved 49 patients with a BMI less than 35 who underwent a Sleeve Gastrectomy and Jejunoileal Bypass (SGJB) procedure between January 2009 and June 2011 at DIPRECA Hospital in Santiago and Hospital Base in Osorno, Chile. The findings revealed a substantial decrease in the BMI, indicating significant results.[55]

EFFECT OF BARIATRIC SURGERY ON WAIST CIRCUMFERENCE AND HIP/WAIST RATIO

In our research, we found a considerable reduction in waist circumference four months after undergoing bariatric surgery for the study group. This decrease was significant as compared to the preoperative values, which were recorded as 116.05 ± 6.38 cm.

A retrospective observational study was done with 1,728 obese patients who underwent bariatric surgery (either Roux en-Y gastric bypass [RYGB] or sleeve gastrectomy [SG]) at a hospital between January 2010 and June 2015. The differences between measurements at baseline and 24 months after surgery, were analyzed. The study group presented with less waist (–28.0 ± 13.0 cm, $p < 0.001$) and hip circumference (–23.3 ± 11.0 cm, $p = 0.049$). [61]

Our study group experienced a noteworthy decline in their hip to waist ratio four months post-bariatric surgery, with the average hip to waist ratio at the conclusion of the fourth month being 0.87, in comparison to the preoperative measurement of 0.94.

A study was carried out in the Department of Surgery, Dayanand Medical College and Hospital, Ludhiana, on male obese subjects who underwent bariatric surgery for morbid obesity. The waist circumference decreased from mean preoperative 132.94 cm to 126.47 cm at 4 weeks and to 106.93 cm at 3 months. The mean hip circumference decreased from preoperative 124.50 cm to 119.14 cm at 4 weeks and 108.21 cm at 3 months. The waist hip ratio decreased from preoperative 1.06 cm to 1.05 cm at 4 weeks and 0.98 cm at 3 months.[62]

Effect of Bariatric Surgery on Type 2 DM

The average pre-operative fasting glucose level was found to be 171.88 mg/dL. After 4 months, the fasting levels decreased to an average of 119.58 mg/dL with a mean difference of 52.30 and a standard deviation of 15.20. This decrease in levels was found to be statistically significant when compared to the pre-operative values.

The average pre-op 2 hour post prandial blood glucose levels also decreased to a post-op value of 155.23 mg/dL at 4 months as compared to pre-op value of 212.38 mg/dL which was statistically significant.

Additionally, the study found a significant drop in HbA1C levels among the 40 patients. The average pre-operative HbA1C level was 7.85 ± 1.28 %, but at 4 months post-operatively, the levels dropped to 6.98 ± 1.07 %. The mean difference was found to be 0.88 with a standard deviation of 0.39 at 4 months.

In a study by Chih-Kun Huang, Rajan Mahendra, Ming-Che Hsin, and Po-Chih Chan published between October 30th, 2014 and April 15th, 2016, the average HBA1C dropped from 6.9 pre-operatively to 6.04 at 6 months. Out of the diabetic patients, 11.53%, 60.86%, and 66.66% achieved an HBA1C of <6.0 and stopped taking diabetic medication at 1, 3, and 6 months, respectively. [45]

A study by Alamo et al. published in 2012 also found positive results. The study involved 49 patients with a BMI less than 35 who underwent sleeve gastrectomy with jejunoileal bypass (SGJB) at DIPRECA Hospital in Santiago and Hospital Base in Osorno, Chile between January 2009 and June 2011. Complete T2DM remission was achieved in 81.6% of patients and partial remission in 18.4%. [55]

EFFECT OF BARIATRIC SURGERY ON LIPID PROFILE

The results of our study showed that there was a reduction in triglyceride levels among the study group who underwent bariatric surgery, with an average triglyceride (TG) level of 150.43 ± 13.69 mg/dL at the end of 4 months compared to 162.55 ± 15.99 mg/dL pre-operatively. The mean difference was 12.13 with a standard deviation of 6.05. Additionally, the results also revealed a decrease in the low-density lipoprotein (LDL) levels with an average of 106.58 ± 13.13 mg/dL at 4 months, compared to the pre-operative value of 117.35 ± 14.43 mg/dL. The mean difference was 10.78 with a standard deviation of 4.94. On the other hand, the study showed an increase in high-density lipoprotein (HDL) levels with an average of 45.13 ± 5.85 mg/dL at 4 months, compared to 41.10 ± 7.30 mg/dL pre-operatively. The mean difference was -4.03 with a standard deviation of 2.84.

A study by Filipe Cunha, Joana Oliveira who retrospectively analysed patients that underwent either Roux-en-Y gastric bypass (RYGB) or sleeve gastrectomy (SG) between 2010 and 2013, showed that at 1 year, both HDL and triglyceride levels improved similarly in all surgeries. Total cholesterol and LDL levels decreased significantly

more in patients who underwent RYGB than in weight-matched patients undergoing AGB or SG.[63]

EFFECT OF BARIATRIC SURGERY ON BLOOD PRESSURE

In our study group, there was a noticeable reduction in systolic blood pressure (SBP) four months after undergoing bariatric surgery. The mean SBP at the end of the fourth month was 120.53 ± 6.52 mmHg, which was significantly lower than the pre-operative values of 125.83 ± 11.46 mmHg. The average difference in SBP was 5.30 mmHg with a standard deviation of 8.81.

However, the decrease in diastolic blood pressure (DBP) four months after bariatric surgery was not as significant. The mean DBP at the end of the fourth month was 82.23 ± 6.16 mmHg, compared to the pre-operative values of 83.08 ± 7.50 mmHg. The average difference in DBP was 0.85 mmHg with a standard deviation of 5.10.

A vast amount of research supports the idea that weight-reduction surgery can significantly improve hypertension control. A meta-analysis by Wilhelm, Young, and Kale-Pradhan, analyzed 57 prospective or randomized trials, including various surgical techniques such as traditional Roux-en-Y gastric bypass (RYGB), laparoscopic adjustable gastric banding (LAGB), and laparoscopic sleeve gastrectomy (LSG). The results were overwhelmingly positive, with 32 out of 57 studies showing improvement in hypertension in 32,628 patients out of 51,241.[64]

BODY COMPOSITION ANALYSIS MONITOR

EFFECT OF BARIATRIC SURGERY ON SUBCUTANEOUS FAT WHOLE BODY, TRUNK, ARMS AND LEGS

The study group underwent bariatric surgery and at 4 months post-surgery, a decrease in subcutaneous fat was observed in all parts of the body. Specifically, the mean whole body subcutaneous fat level at 4 months was found to be 38.81 ± 2.68 %, compared to the pre-operative values of 45.59 ± 6.02 %, with a significant p-value of 0.001.

For the trunk, the mean subcutaneous fat level was 35.89 ± 3.75 % at 4 months, compared to the pre-operative values of 39.55 ± 3.85 %, with a significant p-value of 0.001.

Regarding the arms, the mean subcutaneous fat level was found to be 54.82 ± 3.43 % at 4 months, compared to the pre-operative values of 58.04 ± 4.56 %, with a significant p-value of 0.001.

Finally, the mean subcutaneous fat level in the legs was 54.58 ± 3.92 % at 4 months, compared to the pre-operative values of 57.63 ± 5.96 %, with a significant p-value of 0.001.

EFFECT OF BARIATRIC SURGERY ON SKELETAL MUSCLE WHOLE BODY, TRUNK, ARMS AND LEGS AND SKELETAL MUSCLE INDEX

In our study, there was a decrease in skeletal muscle mass following bariatric surgery at 4 months. The mean skeletal muscle whole body weight at the end of 4 months was 21.47 ± 2.12 kg, as compared to the pre-op values of 25.59 ± 4.24 kg, with a significant p value of 0.001.

Similarly, there was a decrease in skeletal muscle trunk levels, with a mean of 13.62 ± 1.24 kg at the end of 4 months, compared to the pre-op values of 16.41 ± 5.11 kg, with a significant p value of 0.001.

In the arm levels, there was also a decrease in skeletal muscle, with a mean of 11.40 ± 1.47 kg at the end of 4 months, compared to the pre-op values of 16.55 ± 8.89 kg, with a significant p value of 0.001.

In the leg levels, there was a decrease in skeletal muscle, with a mean of 34.87 ± 4.83 kg at the end of 4 months, compared to the pre-op values of 40.63 ± 4.55 kg , with a significant p value of 0.001.

The skeletal muscle index, which is the ratio of skeletal muscle mass in arms and legs to height and an indicator of sarcopenia, also decreased in our study group. The mean skeletal muscle index at the end of 4 months was 17.78 ± 3.03 kg/m^2, compared to the pre-op values of 21.07 ± 2.86 kg/m^2, with a significant p value of 0.001. The mean difference at 4 months was 3.30 with a standard deviation of 1.86.
A study with total of 267 diabetes patients (159 men, 108 women) aged >65 years were recruited. Skeletal muscle mass index was measured to diagnose sarcopenia according to the Asian Working Group for Sarcopenia. Body composition was measured using bioelectrical impedance analysis. The reduction in skeletal muscle mass with aging is expected to be greater in diabetes patients than in non-diabetes patients, suggesting that it is a population at a high risk of sarcopenia[65]

EFFECT OF BARIATRIC SURGERY ON BODY FAT PERCENTAGE

The body fat percentage is a useful indicator of an individual's fitness level as it represents the ratio of fat to the total body weight. Our research group observed a decline in the body fat percentage four months after undergoing bariatric surgery. The mean body fat percentage at the end of four months was 42.00 ± 1.51 %, which was significantly lower than the pre-operative value of 45.22 ± 4.48 % (p value = 0.001). According to the Obesity Medicine Association, individuals with a body fat percentage of 25% or higher for men and 32% or higher for women are considered to have high body fat levels.

EFFECT OF BARIATRIC SURGERY ON VISCERAL FAT PERCENTAGE

The mean visceral fat percentage after 4 months was 17.53 ± 4.28 %, while the pre-operation value was 24.11 ± 5.22 %. This difference was statistically significant with a p value of 0.001. Visceral fat is the type of fat that accumulates around the vital organs and causes long-term inflammation, which can lead to an increased risk of chronic diseases. Thus, bariatric surgery helps to get rid of visceral fat.

EFFECT OF BARIATRIC SURGERY ON RESTING METABOLISM

The resting metabolism refers to the minimum amount of energy or calories that the body needs to function properly while at rest. In our study group that underwent bariatric surgery, there was a decrease in the resting metabolism at the end of 4 months, with the mean resting metabolism being 1547.68 ± 228.56 kcal as compared to the pre-operative values of 2126.18 ± 491.13 kcal. This difference was found to be statistically significant, with a p value of 0.001.

EFFECT OF BARIATRIC SURGERY ON BODY AGE

Our study group underwent a decrease in body age four months after bariatric surgery, with the average body age at the conclusion of four months being 66.03 ± 4.08, as opposed to the pre-operative value of 75.90 ± 6.54. This was a significant improvement, as indicated by the p value of 0.001. The average difference in body age at four months was 9.88 with a standard deviation of 2.75. If a person's metabolic age or body age is higher than their actual age, it signifies the need to enhance their metabolic rate.

These parameters, determined through body composition analysis, can predict the outcome of laparoscopic sleeve gastrectomy post-operatively.

A study was conducted on 30 obese individuals with prediabetes and diabetes (BMI of 30-40 kg/m^2) who underwent bariatric surgery at a tertiary diabetes center in South India from November 2013 to March 2019 with a one-year follow-up. The results showed that body fat, visceral fat area decreased significantly after 12 months compared to

baseline measurements taken using Bioelectrical Impedance Assay (BIA) by Jawon IOI 353. At 6 and12 months post-surgery, there was a significant reduction from the baseline in mean body fat (43 ± 12 vs. 29 ± 8 vs. 24 ± 8, P < 0.001). The percent body fat and visceral fat area were also significantly reduced at 6 and 12 months post-surgery compared to the baseline (42 ± 6 vs. 35 ± 6 vs. 32 ± 7, P < 0.001) and (244 ± 98 vs. 153 ± 85 vs. 120 ± 76, P < 0.001), respectively. The body fat in the left arm, right arm, trunk, left leg and right leg were all significantly reduced at 6 and 12months post-surgery compared to baseline values (P < 0.001). The baseline appendicular skeletal muscle mass index was 17 ± 3 kg/m^2, which reduced to 15 ± 2 and 12 ± 3 kg/m^2 at 6 and 12 months post-surgery. In the gastrointestinal diversionary procedure, the mean body fat was significantly reduced at 6 and12 months postoperative period compared to the baseline (P < 0.001). In the sleeve gastrectomy procedure, the mean body fat was significantly reduced at 6 and 12 months compared to the baseline (P < 0.001).[66]

A study among 151 patients who underwent laparoscopic OAGB-MGB, SG and RYGB surgery at Hazrat-eRasool General Hospital in Tehran, was conducted between April 2018 and June 2019. Body composition was analyzed using a Tanita BC-418 analyzer from Tanita Corp. in Tokyo, Japan, to determine fat range (%),muscle mass (kg), visceral fat (level) [68]

TABLE 23: EFFECT OF DIFFERENT BARIATRIC SURGERIES ON BODY COMPOSITION

	MGB			**SG**			**RYGB**			
	Preop	**3 months postop**	**6 months postop**	**Preop**	**3 months postop**	**6 months postop**	**Preop**	**3 months postop**	**6 months postop**	**P-value**
Fat range (%)	45.19 ± 8.64	40.68 ± 6.94	35.05 ± 8.09	46.79 ± 5.51	40.69 ± 6.11	36.48 ± 6.99	47.58 ± 4.59	40.59 ± 5.96	35.38 ± 6.99	< 0.001
Visceral fat (level)	16.46 ± 5.68	11.78 ± 3.75	8.98 ± 3.41	15.96 ± 4.03	11.09 ± 3.14	8.78 ± 3.10	15.90 ± 4.13	10.72 ± 2.61	8.40 ± 2.59	< 0.001
Muscle mass (kg)	60.97 ± 13.33	55.16 ± 11.30	53.79 ± 10.68	60.83 ± 9.41	54.88 ± 7.47	52.93 ± 7.33	58.87 ± 10.55	53.39 ± 8.73	52.17 ± 8.29	< 0.001

EFFECT OF BARIATRIC SURGERY ON TIME IN RANGE DETERMINED BY CONTINUOUS GLUCOSE MONITORING SENSOR

The time in range refers to the amount of time a person spends within the target blood glucose range, which is determined using a continuous glucose monitoring sensor. Our study group showed an increase in time in range four months after undergoing bariatric surgery. The mean time in range at the end of four months was 66.77 ± 14.00 %, compared to the pre-operative values of 53.87 ± 18.38 %, with a significant p value of 0.001.

In a study, researchers from Jagiellonian University Medical College in Krakow, Poland, used the FreeStyle Libre CGM to study patients with and without type 2 diabetes (T2D) who underwent 2 methods of bariatric surgery, laparoscopic sleeve gastrectomy and gastric bypass. Among the 32 patients, glucose concentration was within the target range of 3.9 to 6.7 mmol/L, 68% of the time during the 10-day postoperative period. [67]

EFFECT OF BARIATRIC SURGERY ON ALBUMIN

Bariatric surgery can cause complications such as severe protein malnutrition. The level of serum albumin after 4 months of surgery was found to be similar to the pre-operative levels, with a mean of 4.22 ± 0.33 compared to 4.27 ± 0.44 g/dL. The results showed an insignificant difference with a p value of 0.246 and a mean difference of 0.04 with an SD of 0.23, suggesting that this type of surgery results in reduced nutritional deficiencies in post-operative patients.

A study on 151 patients at Hazrat-e Rasool General Hospital in Tehran, Iran showed that the Albumin concentrations did not show significant changes within the groups at different time points (P = 0.413). [68]

TABLE 24 - EFFECT OF DIFFERENT BARIATRIC SURGERIES ON ALBUMIN LEVELS

	OAGB-MGB			SG			RYGB			
	Preop	**3 months postop**	**6 months postop**	**Preop**	**3 months postop**	**6 months postop**	**Preop**	**3 months postop**	**6 months postop**	**P-value**
Albumin levels (g/l)	4.27 ± 0.36	4.32 ± 0.52	4.21 ± 0.37	4.42 ± 0.40	4.37 ± 0.41	4.35 ± 0.38	4.31 ± 0.39	4.28 ± 0.33	4.28 ± 0.51	0.41

SUMMARY AND CONCLUSION

There has been a noticeable surge in the number of cases of obesity and its related metabolic issues in Asia, where 60% of the world's population resides and is already at a higher risk of developing diabetes. Obesity is considered a major contributor to cardiovascular disease as it raises the risk of ASCVD through other risk factors, including hypercholesterolemia, hypertension, hyperglycemia, and emerging risk factors such as atherogenic dyslipidemia, insulin resistance, pro inflammatory state, and pro thrombotic state.

The goal of bariatric surgery is to cause significant, clinically significant weight loss that can lower the impact of obesity-related medical problems to an acceptable level. The loss of fat, especially visceral fat, leads to better insulin sensitivity and glucose disposal.

Laparoscopic proximal jejunal bypass with sleeve gastrectomy (LPJB-SG) was first introduced in 2004 by de Menezes. This surgical procedure is preferred because of its ease of use, reproducibility, and reversibility of bowel anatomy, making it a great choice for obese patients. It is a logical combination of the successful results from sleeve gastrectomy and minimal malabsorption to promote weight loss and plays a crucial role in the remission of diabetes without nutritional deficiencies. LPJB-SG is a safe, feasible, and effective solution for treating obesity, achieving long-term remission of type II diabetes mellitus, and improving cardiovascular health, resulting in an improved quality of life. This study demonstrated significant improvements in body weight, fasting blood sugar, glycosylated haemoglobin, the amount of time in which an individual maintains the target blood sugar levels monitored by continuous glucose monitoring sensor, lipid profile, various other parameters obtained by body composition analysis monitor. As none of the patients suffered from any major adverse effects related to the surgery, this concludes that it is a safe and effective surgery.

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Sr. No	MRD No	Name	Age	Sex	Date	history of presenting complaints	Medical treatment for obesity	Any other therapy for obesity	Type of Surgery performed	Comorbidities	Blood Pressure (mmHg)			
											Pre-op SBP	4 months SBP	Pre-op DBP	4 months DBP
1	760282	HK	54	F	Jan-20	MORBID OBESITY	Y	N	LPJB-SG	DM-2 , HTN	140	116	90	80
2	719448	JS	38	M	Jan-20	MORBID OBESITY	Y	N	LPJB-SG	DM-2	134	124	70	80
3	759333	SS	43	M	Jan-20	MORBID OBESITY	N	N	LPJB-SG	DM-2	110	119	80	80
4	182910	HS	44	F	Jan-20	MORBID OBESITY	N	N	LPJB-SG	DM-2	110	110	80	76
5	812053	JP	58	M	Feb-20	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN,OSA	130	130	90	90
6	505192	AG	39	M	Feb-20	MORBID OBESITY	N	N	LPJB-SG	DM-2	120	110	80	86
7	851443	NQ	40	F	Feb-20	MORBID OBESITY	Y	N	LPJB-SG	DM-2	130	126	70	70
8	852433	RS	51	F	Feb-20	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN	140	130	80	88
9	867708	GG	38	M	Mar-20	MORBID OBESITY	Y	N	LPJB-SG	DM-2	136	122	80	80
10	814213	NJ	38	F	Oct-20	MORBID OBESITY	N	N	LPJB-SG	DM-2	120	120	80	82
11	651112	AA	40	F	Oct-20	MORBID OBESITY	Y	N	LPJB-SG	DM-2	110	114	80	87
12	900644	IK	51	F	Oct-20	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN	140	136	90	90
13	679675	KK	61	M	Oct-20	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN,OSA	130	130	90	96
14	927968	AK	53	F	Nov-20	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN	110	121	80	80
15	971787	PA	46	F	Nov-20	MORBID OBESITY	N	N	LPJB-SG	DM-2	120	120	70	78
16	980743	HK	54	M	Nov-20	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN	140	126	90	86
17	993257	YG	36	F	Nov-20	MORBID OBESITY	Y	N	LPJB-SG	DM-2	120	120	80	80
18	1000138	SK	38	M	Dec-20	MORBID OBESITY	Y	N	LPJB-SG	DM-2	130	122	90	84
19	8272	PD	36	M	Dec-20	MORBID OBESITY	Y	N	LPJB-SG	DM-2	110	110	80	80
20	1083423	SS	45	F	Dec-20	MORBID OBESITY	N	N	LPJB-SG	DM-2	122	110	80	80
21	752727	NK	45	F	Dec-20	MORBID OBESITY	N	N	LPJB-SG	DM-2	120	120	90	90
22	743901	SS	38	M	Jan-21	MORBID OBESITY	N	N	LPJB-SG	DM-2	120	120	80	80
23	36331	OP	74	M	Jan-21	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN,CAD	138	130	88	80
24	704663	AR	52	F	Jan-21	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN	120	120	80	80
25	1000138	SK	47	F	Jan-21	MORBID OBESITY	Y	N	LPJB-SG	DM-2,OSA	110	110	90	90
26	1081256	PD	36	F	Feb-21	MORBID OBESITY	Y	N	LPJB-SG	DM-2,PCOD	110	110	70	70
27	1035410	KK	45	F	Mar-21	MORBID OBESITY	Y	N	LPJB-SG	DM-2,HTN	120	120	90	90
28	1083423	SS	45	M	Apr-21	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN,OSA	148	122	88	80

Sr. No	MRD No	General Physical Examination												INVESTIGATIONS	
		Height (m)	Weight (kg) Pre-op	Weight (kg) 4 months	Ideal weight (kg)	Weight loss (%)	BMI (Kg/m2)		Waist circumference (cm)		Hip/Waist Ratio		Hb (gm/dL)	
							Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months
1	760282	1.7	115	96	42.33	26.15	39.7923	33.2179	111.2	105.2	0.9	0.85	13.8	12.5
2	719448	1.6	90	75	39.84	29.90	35.1563	29.2968	107.2	101	0.96	0.91	12.4	12
3	759333	1.7	123	100	42.33	28.51	42.5606	34.602	115	106.2	1.11	1	11.9	11.7
4	182910	1.55	139	110	38.595	28.88	57.8563	45.8333	129	118.3	0.88	0.8	13.5	13.2
5	812053	1.6	132.9	115	39.84	19.23	51.914	44.9218	123	117.9	1.15	1.01	13.2	13
6	505192	1.64	134	110	40.836	25.76	49.8215	41.0447	121	114	1.09	0.98	12.2	12.1
7	851443	1.54	95	70	38.346	44.13	40.0573	29.5358	113.1	100.6	0.89	0.82	14.5	14.2
8	852433	1.68	108	80	41.832	42.32	38.2653	28.3687	110.3	99	0.84	0.8	11.4	11.3
9	867708	1.57	98	78	39.093	33.95	39.7582	31.7073	111	103.4	1.03	0.99	11.8	11.7
10	814213	1.625	100	85	40.4625	25.19	37.8698	32.1969	109.2	104.3	0.85	0.81	9.8	9.9
11	651112	1.57	98	75	39.093	39.04	39.7582	30.4878	111	102.3	0.92	0.85	9.6	10.3
12	900644	1.55	114	88	38.595	34.48	47.4505	36.6666	119.4	108.4	0.81	0.77	12.3	12.5
13	679675	1.76	132	104	43.824	31.75	42.6136	34.6666	115.3	106.2	1.01	0.95	11.3	11.9
14	927968	1.57	87	70	39.093	35.49	35.2955	28.4552	107.2	100.1	0.84	0.78	11.6	12
15	971787	1.5	127	100	37.35	30.12	56.4444	44.4444	128	117.5	0.9	0.81	13.1	12.8
16	980743	1.8	120	95	44.82	33.25	37.037	29.3209	109.3	101.3	0.97	0.91	14.2	13.7
17	993257	1.5	100	78	37.35	35.12	44.4444	34.6666	117.5	106.2	0.82	0.73	9.2	11.3
18	1000138	1.84	146	110	45.816	35.93	43.1238	32.5443	116	104.9	1.03	0.96	9.9	11.7
19	8272	1.9	144	115	47.31	29.99	39.8891	31.8559	111.3	103.9	0.96	0.92	10.5	11.2
20	1083423	1.6	120	98	39.84	27.45	46.875	38.2812	118.1	110.5	0.86	0.8	10.1	11.5
21	752727	1.58	97	72	39.342	43.36	38.8559	28.9156	111.2	99.9	0.89	0.82	13.7	13
22	743901	1.38	105	90	34.362	21.24	55.1354	47.3684	127	118.4	1.04	0.95	12.4	12.6
23	36331	1.56	112	95	38.844	23.24	46.0223	39.0946	117.8	110.1	0.99	0.93	9.7	12.1
24	704663	1.57	116	90	39.093	33.81	47.0607	36.5853	119.2	108.3	0.87	0.82	10.8	11.2
25	1000138	1.63	106	80	40.587	39.75	40	30.1886	112	102	0.91	0.81	13.9	12.9
26	1081256	1.82	117	90	45.318	37.67	35.3474	27.1903	107.3	97	0.89	0.8	11.9	11.2
27	1035410	1.67	118	98	41.583	26.17	42.446	35.2517	115.2	107.5	0.94	0.85	12.2	12
28	1083423	1.55	140	100	38.595	39.45	58.3333	41.6666	130	114.3	1.05	0.96	9.1	11.3

Sr. No	MRD No	S.creat (mg/dL)		TG (mg/dL)		LDL (mg/dL)		HDL (mg/dL)		FBS (mg/dL)		2 HR-PP (mg/dL)		HBA1c (%)		SGOT (U/lt)	
		Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-Op	4 months
1	760282	0.8	0.76	140	128	105	89	43	48	192	135	212	154	8.2	7.4	40	39
2	719448	0.96	0.87	150	140	103	97	47	48	171	100	200	166	7.3	6	34	33
3	759333	1.1	1	160	148	110	99	41	45	162	85	215	156	7	5.9	25	25
4	182910	0.78	0.79	162	155	119	114	43	45	144	80	200	134	6.9	6.1	20	21
5	812053	1.3	1.5	196	178	117	98	48	49	158	90	224	135	7.1	6.7	36	35
6	505192	1.2	1.1	155	146	160	144	44	48	176	110	190	156	7.5	6.9	28	29
7	851443	0.88	0.87	158	151	91	87	29	35	199	145	289	198	9.9	8	22	24
8	852433	0.71	0.66	162	158	100	91	40	43	190	135	202	178	8	7.4	34	35
9	867708	0.96	0.8	178	160	139	131	49	47	201	158	222	176	8.5	7.8	39	38
10	814213	1.23	1.1	174	158	117	112	48	49	200	144	296	199	10	8.9	40	37
11	651112	1.2	0.99	166	159	120	111	45	46	147	100	190	124	6.9	6.1	20	22
12	900644	1.1	0.91	168	155	105	98	34	39	176	104	191	145	7.3	6.6	24	25
13	679675	0.91	1	170	157	108	91	42	43	160	102	256	166	7.2	6.3	31	30
14	927968	0.95	1.1	192	176	94	88	26	30	158	100	223	171	7	5.9	36	35
15	971787	0.77	0.98	150	140	120	113	49	50	147	95	190	123	6.9	5.7	38	31
16	980743	0.72	0.82	156	141	113	101	47	49	195	154	204	163	8	6.8	21	20
17	993257	0.89	0.92	164	142	110	99	38	42	221	190	323	201	11	9.5	29	28
18	1000138	0.84	0.91	159	150	124	117	41	46	152	106	191	143	7.6	6.9	23	22
19	8272	0.91	0.85	167	154	127	119	39	48	144	102	204	167	7	6.4	26	25
20	1083423	1	0.99	154	138	102	89	41	45	197	126	216	151	8.6	7.5	27	26
21	752727	1.1	1	150	141	91	87	29	35	172	117	211	154	7.6	6.8	31	26
22	743901	1.15	1.1	130	122	117	112	48	50	160	101	206	138	7.2	6.6	27	25
23	36331	1.12	0.99	183	160	98	88	46	48	224	160	245	177	9.5	8.3	33	30
24	704663	0.84	0.81	210	180	105	100	50	54	201	166	234	168	12	9.8	32	33
25	1000138	0.94	0.89	159	131	115	98	35	39	186	115	190	134	7	5.9	22	20
26	1081256	0.78	0.91	165	155	126	118	42	45	177	111	199	130	6.9	6.1	26	25
27	1035410	0.7	0.81	159	152	118	108	45	46	181	122	205	155	7.1	6.6	25	25
28	1083423	1.23	1.1	171	164	130	110	22	36	111	90	188	133	6.7	6	35	34

Sr. No	MRD No					Body Composition Analysis Monitor											
		SGPT (U/lt)		Albumin (gm/dL)		Subcutaneous fat								Skeletal Muscle			
		Pre-op	4 months	Pre-op	4 months	Whole body %		Trunk %		Arms %		Legs %		Whole body kg		Trunk kg	
						Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months
1	760282	24	23	3.5	3.48	43.1	37.1	37.6	34.2	56.7	53.3	54.6	52.5	24.2	21.9	14.1	13.4
2	719448	25	24	4.67	4.8	39.8	36.9	36.8	33.2	54.8	52.2	53.5	51.8	21.8	20.7	12.8	12.7
3	759333	28	28	3.66	3.81	43.6	37.9	37.9	34.8	54.8	53.8	54.9	52.9	24.7	22.2	14.9	13.9
4	182910	20	27	4.89	4.71	53.4	42.6	44.6	42.7	64.2	60.2	66.8	61.7	26.3	20.7	16.5	14.3
5	812053	21	26	4.35	4.23	53.2	42.7	44.7	42.1	64.1	60.4	66.5	61.6	26.1	20.5	16.9	14.2
6	505192	33	33	3.9	4.1	53.1	42.1	44.9	42.1	64.8	60.9	66.1	61.2	26.6	20.1	16.6	14.9
7	851443	35	36	5.1	4.96	39.6	36.8	36.4	33.9	54.6	52.6	53.2	51.9	22.8	20.3	12.9	12.6
8	852433	37	36	4.21	4.13	41.4	37	36.9	33.4	54.9	52.3	53.7	51.9	22.9	20.8	13.8	12.8
9	867708	39	38	4.44	4.21	39.6	36.8	36.4	33.9	54.6	52.6	53.2	51.9	22.8	20.3	12.9	12.6
10	814213	40	39	3.57	3.78	40.6	36.2	36.1	32.9	54.2	51.7	53.1	51.2	22.2	20.4	13.4	12.3
11	651112	41	36	3.99	4.12	39.6	36.8	36.4	33.9	54.6	52.6	53.2	51.9	22.8	20.3	12.9	12.6
12	900644	22	24	4.25	4.34	42.9	36.5	37.4	33.2	56.6	52.8	54.1	51.5	23.9	21.7	13.9	13.2
13	679675	28	26	4.67	4.73	53.1	42.4	43.7	42.2	64.4	60.5	66.3	61.3	26.2	20.2	16.9	14.6
14	927968	29	26	4.55	4.29	39.8	36.9	36.8	33.2	54.8	52.2	53.5	51.8	21.8	20.7	12.8	12.7
15	971787	26	25	4.21	4.38	53.1	42.1	44.9	42.1	64.8	60.9	66.1	61.2	26.6	20.1	16.6	14.9
16	980743	25	24	4.19	4.11	43.6	37.9	37.9	34.8	54.8	53.8	54.9	52.9	24.7	22.2	14.9	13.9
17	993257	31	30	5.01	4.87	40.7	36.1	36.2	32.5	54.1	51.5	53.2	51.1	22.2	20.1	13.3	12.1
18	1000138	32	31	3.59	4.11	49.8	38.2	40.1	33.3	59.2	54.7	58.1	56.1	28.2	28.1	19.4	16.5
19	8272	37	35	4.13	4.01	49.8	38.2	40.1	33.3	59.2	54.7	58.1	56.1	28.2	28.1	19.4	16.5
20	1083423	36	33	4.71	4.56	43.6	37.9	37.9	34.8	54.8	53.8	54.9	52.9	24.7	22.2	14.9	13.9
21	752727	33	36	4.68	4.11	39.8	36.9	36.8	33.2	54.8	52.2	53.5	51.8	21.8	20.7	12.8	12.7
22	743901	34	39	4.12	3.98	41.2	36.9	36.8	33.2	54.8	52.2	53.5	51.8	22.8	20.1	13.8	12.2
23	36331	40	36	3.67	3.99	42.3	37.2	37.2	33.6	55.2	52.4	53.7	52.1	37.2	21	33.6	12.7
24	704663	35	34	3.98	4.15	42.3	37.2	37.2	33.6	55.2	52.4	53.7	52.1	37.2	21	33.6	12.7
25	1000138	41	38	3.71	3.9	41.2	36.9	36.8	33.2	54.8	52.2	53.5	51.8	22.8	20.7	13.8	12.7
26	1081256	40	34	4.37	4.22	46.4	41.2	40.4	36.8	58.4	54.8	56.2	53.5	26.7	22.8	16.8	13.8
27	1035410	40	36	3.99	4.05	46.4	41.2	40.4	36.8	58.4	54.8	56.2	53.5	26.7	22.8	16.8	13.8
28	1083423	36	35	4.16	4.21	49.8	38.2	40.1	33.3	59.2	54.7	58.1	56.1	28.2	28.1	19.4	16.5

Sr. No	MRD No															Continuous glucose monitoring sensor	
						Skeletal Muscle Index kg/m2		Body fat percentage (%)		Visceral fat (%)		Resting Metabolism (kcal)		Body age		Time in range %	
		Arms kg		Legs kg													
		Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months
1	760282	14.2	11.2	38.4	25.2	18.2	12.5	43.5	42.1	20.5	14.5	1977	1400	73	64	NIL	NIL
2	719448	12.3	10	36.4	34	19	17.1	42.2	41.3	19.5	13.5	1955	1390	72	63	NIL	NIL
3	759333	13.6	11.7	40.1	25.9	18.5	13	44.1	43.2	21.1	15.3	1984	1410	74	65	NIL	NIL
4	182910	14.4	13.2	45.2	40.8	24.8	22.5	46.2	40.1	30.5	22.8	2289	1300	76	66	NIL	NIL
5	812053	14.2	13.7	45	40.1	23.1	21	46.8	40.9	31.9	21.8	2000	1489	77	67	NIL	NIL
6	505192	14.8	13.2	45.4	40.9	23.1	20.8	46.3	41.7	32	23.7	2010	1800	76	66	NIL	NIL
7	851443	12.6	11.1	36.8	34.8	21.4	19.9	42.3	39.9	20.1	12.4	1900	1300	71	62	NIL	NIL
8	852433	13.6	10.2	37.8	34.1	18.3	15.8	44.2	43.3	21.3	15.4	1994	1432	74	65	NIL	NIL
9	867708	12.6	11.1	36.8	34.8	20.5	19.1	42.3	39.9	20.1	12.5	1999	1400	71	62	NIL	NIL
10	814213	13	9.7	37.1	33.8	19.2	16.7	42	41	19.1	12.9	1950	1381	72	63	20	50
11	651112	12.6	11.1	36.8	34.8	20.5	19.1	42.3	39.9	20.1	12.5	1999	1400	71	62	70	80
12	900644	13.3	10.9	37.4	25.1	21.1	15	43	41	20	14	1960	1390	73	64	60	70
13	679675	14.5	13.7	45.9	40.1	20.1	17.9	46.8	40.9	31.9	21.8	2000	1489	77	67	60	70
14	927968	12.3	10	36.4	34	20.2	18.3	42.2	41.3	19.5	13.5	1955	1390	72	63	60	80
15	971787	14.8	13.2	45.4	40.9	26.7	24	46.3	41.7	32	23.7	2010	1800	76	66	70	80
16	980743	13.6	11.7	40.1	25.9	16.7	11.7	44.1	43.2	21.1	15.3	1984	1410	74	65	50	70
17	993257	12.9	9.4	37	32.5	22.1	18.6	42.1	43.1	21.1	15.2	1987	1414	73	64	10	30
18	1000138	18.6	10.6	39	38.5	17.4	14.8	47.5	41.1	30.1	22.1	2500	1800	80	71	60	70
19	8272	18.6	10.6	39	38.5	16	13.6	47.5	41.1	30.1	22.1	2500	1800	80	71	60	70
20	1083423	13.6	11.7	40.1	25.9	20.9	14.6	44.1	43.2	21.1	15.3	1984	1410	74	65	50	60
21	752727	12.3	10	36.4	34	20.2	18.3	42.2	41.3	19.5	13.5	1955	1390	72	63	60	70
22	743901	13.3	10.1	37.4	33.8	26.6	23.1	44	43	19.9	14.9	1990	1420	74	65	60	70
23	36331	52.4	10.3	52.1	34	22.7	18.45	45	43	19.8	14.7	1980	1400	74	65	30	50
24	704663	52.4	10.3	52.1	34	23.5	18.45	45	44	21	16	1999	1490	74	65	0	30
25	1000138	13.3	10	37.4	34	19.5	16.9	42.2	41.3	19.5	13.5	1955	1390	72	63	60	80
26	1081256	17.4	13.3	39.2	37.4	17.1	15.3	48.6	42.2	23.5	19.5	2290	1900	84	72	70	80
27	1035410	17.4	13.3	39.2	37.4	20.9	18.7	48.6	42.2	23.5	19.5	2290	1900	84	72	60	70
28	1083423	18.6	10.6	39	38.5	25.6	21.8	47.5	41.1	30.1	22.1	2500	1800	80	71	70	80

Sr. No	MRD No	Name	Age	Sex	Date	history of presenting complaints	Medical treatment for obesity	Any other therapy for obesity	Type of Surgery performed	Comorbidities	Blood Pressure (mmHg)			
											Pre-op SBP	4 months SBP	Pre-op DBP	4 months DBP
29	1288193	IS	54	M	Jun-21	MORBID OBESITY	Y	N	LPJB-SG	DM-2,HTN	131	123	88	88
30	1144044	GK	37	F	Aug-21	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTY,PCOD	139	120	89	80
31	1205191	NK	52	F	Nov-21	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN,HTY	130	126	100	88
32	1258871	NB	45	M	Feb-22	MORBID OBESITY	N	N	LPJB-SG	DM-2	110	110	70	70
33	1256585	NK	43	F	Feb-22	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN	139	120	90	80
34	1266325	HK	41	M	Mar-22	MORBID OBESITY	Y	N	LPJB-SG	DM-2,HTN,HTY	140	120	90	82
35	1263834	JS	38	M	Mar-22	MORBID OBESITY	Y	N	LPJB-SG	DM-2	120	120	80	80
36	1246764	BB	56	F	Mar-22	MORBID OBESITY	Y	N	LPJB-SG	DM-2,HTN	146	124	90	88
37	1215106	HK	45	F	Apr-22	MORBID OBESITY	Y	N	LPJB-SG	DM-2	120	120	80	80
38	1286302	BK	55	M	Apr-22	MORBID OBESITY	N	N	LPJB-SG	DM-2	120	120	80	80
39	1234247	SS	39	M	Apr-22	MORBID OBESITY	N	N	LPJB-SG	DM-2,HTN	130	130	90	90
40	1296615	SK	51	F	Apr-22	MORBID OBESITY	N	N	LPJB-SG	DM-2	120	120	70	70

Sr. No	MRD No	General Physical Examination												INVESTIGATIONS	
		Height (m)	Weight (kg) Pre-op	Weight (kg) 4 months	Ideal weight (kg)	Weight loss (%)	BMI (Kg/m2)		Waist circumference (cm)		Hip/Waist Ratio		Hb (gm/dL)	
							Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months
29	1288193	1.65	109	88	41.085	30.92	40.0735	35.3529	112.9	107.6	0.99	0.95	11.5	11
30	1144044	1.64	104	82	40.836	34.83	38.8059	30.597	111.3	102.4	0.86	0.79	11.7	11.2
31	1205191	1.56	110	85	38.844	35.13	45.2674	34.9794	116.3	106.4	0.87	0.78	12.5	11.9
32	1258871	1.67	129	103	41.583	29.74	46.4028	37.0503	118	109.6	0.99	0.95	10.1	11.5
33	1256585	1.71	165	122	42.579	35.12	56.5068	41.7808	128	113.1	0.89	0.8	14	13.2
34	1266325	1.68	134	108	41.832	28.21	47.5177	38.2978	120.2	111	1.02	0.95	12.1	11.4
35	1263834	1.54	122	101	38.346	25.10	51.476	42.616	123.2	115	0.98	0.91	11.5	11.8
36	1246764	1.7	135	104	42.33	33.45	46.712	35.9861	118.5	107.8	0.87	0.8	9.2	11.4
37	1215106	1.69	100	84	42.081	27.62	35.087	29.4736	107	100.5	0.84	0.78	10.8	11
38	1286302	1.61	115	89	40.089	34.71	44.4015	34.3629	116	106.2	1	0.95	11.7	11.1
39	1234247	1.67	120	99	41.583	26.78	43.1654	35.6115	115.4	107.7	0.99	0.93	10-Jan	11.3
40	1296615	1.54	95	77	38.346	31.77	40.0843	32.4894	112.2	104.2	0.84	0.76	12.2	11.6

Sr. No	MRD No	S.creat (mg/dL)		TG (mg/dL)		LDL (mg/dL)		HDL (mg/dL)		FBS (mg/dL)		2 HR-PP (mg/dL)		HBA1c (%)		SGOT (U/lt)	
		Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-Op	4 months
29	1288193	1.14	0.91	155	138	132	112	30	38	156	101	194	143	6.7	6.1	30	28
30	1144044	0.83	0.87	128	122	120	116	31	37	126	99	187	131	6.6	5.8	31	30
31	1205191	0.91	1	145	140	121	114	43	48	166	111	180	134	6.9	6.3	32	31
32	1258871	0.79	0.84	147	138	134	120	50	55	123	101	210	163	7.9	7.1	36	33
33	1256585	1.13	1.1	167	158	112	106	41	48	189	129	201	134	8	7.7	39	36
34	1266325	1.21	1.06	155	149	141	128	38	40	133	104	207	156	6.4	6	34	33
35	1263834	0.85	0.77	180	167	129	114	49	55	172	135	191	133	8.1	7.3	42	37
36	1246764	0.75	0.81	171	156	128	111	41	46	119	97	180	121	6.6	6.2	47	35
37	1215106	0.82	0.94	159	146	117	104	55	57	199	145	206	167	7.6	6.9	49	39
38	1286302	1.1	0.88	151	140	136	120	37	42	210	149	222	199	9.2	8.7	41	37
39	1234247	1.03	1	166	159	121	106	38	46	199	156	204	177	9.7	8.9	38	36
40	1296615	1.09	0.99	170	165	119	103	40	45	181	113	197	156	8.4	7.1	42	38

Sr. No	MRD No					Body Composition Analysis Monitor											
		SGPT (U/lt)		Albumin (gm/dL)		Subcutaneous fat								Skeletal Muscle			
		Pre-op	4 months	Pre-op	4 months	Whole body %		Trunk %		Arms %		Legs %		Whole body kg		Trunk kg	
						Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months
29	1288193	35	34	4.53	4.44	41.2	36.9	36.8	33.2	54.8	52.2	53.5	51.8	22.8	20.7	13.8	12.7
30	1144044	29	30	4.36	4.28	40.7	36.1	36.2	32.5	54.1	51.5	53.2	51.1	22.2	20.1	13.3	12.1
31	1205191	30	29	3.66	3.89	41.2	36.9	36.8	33.2	54.8	52.2	53.5	51.8	22.8	20.1	13.8	12.2
32	1258871	31	30	3.81	4.1	53.1	42.1	44.9	42.1	64.8	60.9	66.1	61.2	26.6	20.1	16.6	14.9
33	1256585	35	34	4.81	4.66	64.5	46.4	52.4	40.4	71.2	58.4	75.8	56.2	40.6	22.8	31.2	13.8
34	1266325	31	37	5.11	4.89	53.1	42.1	44.9	42.1	64.8	60.9	66.1	61.2	26.6	20.1	16.6	14.9
35	1263834	36	33	4.34	4.11	53.1	42.1	44.9	42.1	64.8	60.9	66.1	61.2	26.6	20.1	16.6	14.9
36	1246764	33	35	4.22	3.96	53.2	42.9	44.4	42.5	64.2	60.1	66.5	61.4	26.7	20.1	16.4	14.9
37	1215106	40	37	4.74	4.25	40.7	36.1	36.2	32.5	54.1	51.5	53.2	51.1	22.2	20.1	13.3	12.1
38	1286302	36	35	3.9	3.86	46.4	41.2	40.4	36.8	58.4	54.8	56.2	53.5	26.7	22.8	16.8	13.8
39	1234247	33	36	4.19	3.93	43.6	37.9	37.9	34.8	54.8	53.8	54.9	52.9	24.7	22.2	14.9	13.9
40	1296615	35	33	4.67	4.19	39.8	36.9	36.8	33.2	54.8	52.2	53.5	51.8	21.8	20.7	12.8	12.7

Sr. No	MRD No															Continuous glucose monitoring sensor	
						Skeletal Muscle Index kg/m2		Body fat percentage (%)		Visceral fat (%)		Resting Metabolism (kcal)		Body age		Time in range %	
		Arms kg		Legs kg													
		Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months	Pre-op	4 months
29	1288193	13.3	10	37.4	34	18.7	16.2	42.2	41.3	19.5	13.5	1955	1390	72	63	70	80
30	1144044	12.9	9.4	37	32.5	19.1	16.1	42.1	43	21	15	1980	1406	73	64	70	80
31	1205191	13.3	10.1	37.4	33.8	21.1	18.2	44	43	19.9	14.9	1990	1420	74	65	70	70
32	1258871	14.8	13.2	45.4	40.9	22.2	15.9	46.3	41.7	32	23.7	2010	1800	76	66	60	60
33	1256585	30.4	13.3	50.2	37.4	27.7	17.4	69.4	48.6	30.1	23.5	4988	2290	110	84	50	60
34	1266325	14.8	13.2	45.4	40.9	21.5	19.3	46.3	41.7	32	23.7	1999	1600	76	66	70	80
35	1263834	14.8	13.2	45.4	40.9	26.1	23.5	46.3	41.7	32	23.7	2010	1800	76	66	50	60
36	1246764	14.2	13.2	45.4	40.9	21.2	19.3	46.2	41.2	33	25.7	2010	1800	76	66	70	80
37	1215106	12.9	9.4	37	32.5	17.8	14.9	42.1	43	21	15	1980	1406	73	64	60	70
38	1286302	17.4	13.3	39.2	37.4	22.6	20.2	48.6	42.2	23.5	19.5	2290	1900	84	72	40	50
39	1234247	13.6	11.7	40.1	25.9	19.8	13.9	44.1	43.2	21.1	15.3	1984	1410	74	65	30	50
40	1296615	12.3	10	36.4	34	21.1	19.1	42.2	41.3	19.5	13.5	1955	1390	72	63	50	70

PROFORMA

SERIAL NO:

NAME:

AGE/SEX:

M.R.D.NO:

Adm. NO:

DOA:

DOD:

ADDRESS:

History of Present illness:

Past History:

- Medical treatment for obesity
- Any other therapy for obesity

Other Comorbidities:

History of Diabetes Mellitus

Hypertension

CAD

PCOD

OSA

Thyroid disease

Signature of Candidate

Signature of Supervisor

Previous Treatment / Surgery / Intervention biopsy :

Occupation:

General Physical Examination:

Apperance -

BP -	Pallor -	Lymphadenopathy -
PR-	Icterus -	Edema -
RR-	Cyanosis-	Petechie/ Purpura -
Temp -	Clubbing -	Others -

SpO2 (On room air)

Significant Systemic Examination:

Chest -

Per – Abdomen -

CVS -

CNS -

Signature of Candidate

Signature of Supervisor

Investigations

	Pre- Operatively	After 4 Months
Blood Pressure(Systolic/ Diastolic mm Hg)		
Height (m^2)		
Weight (Kg)		
BMI (Kg/m^2)		
Waist Circumference		
Hip/Waist Ratio		
Hemoglobin		
S.Creatinine		
S.Triglycerides		
LDL		
HDL		
Fasting Blood Sugar		
2-hour Post- Prandial		
HBA1c		
SGOT		
SGPT		
Albumin		
Subcutaneous fat • Whole body • Trunk • Arms • Legs		
Skeletal Muscle • Whole body • Trunk • Arms • Legs		
• Skeletal Muscle Index		
Body fat percentage (%)		
Visceral fat (%)		
Resting Metabolism(kcal)		
Body Age		
Continuous Glucose Monitoring Sensor (CGMS)- Time in Range		

Surgery Performed

Signature of Candidate **Signature of Supervisor**

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No. BFUHS/2K21p-TH/ 197 Date 6/1/2022

The Principal,
DMC, Ludhiana.

Subject: **Approval of Plan of Thesis.**

This is to inform you that the Faculty of Medical Sciences in its meeting held on 29.10.2021 has approved the plan of thesis of **Harprabhjot Kaur**, a student of your college for **MS General Surgery** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
To study outcomes of laparoscopic proximal jejunal bypass with sleeve gastrectomy.

Supervisor
Dr. Ashish Ahuja
Prof.,
Dept. of Surgery,
DMCH, Ludhiana.

Co-Supervisor

Dr. P. S. Nain
Prof.,
Dept. of Surgery,
DMCH, Ludhiana.

Dr. Saurabh Arora
Asst. Prof.,
Dept. of Endocrinology,
DMCH, Ludhiana.

The student has to submit the four copies of thesis (along with PDF format) , to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She must directed to attach a photocopy of this letter with the forwarding letter while submitting thesis to the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic,(if any).

Dr. S P Singh MS(Oph)
Controller of Examinations

Note :

131. If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.

132. The student may submit the thesis as per the schedule already conveyed i.e for May/June examination 30th Nov of the preceding the year of examination and for Nov/Dec examinations 31st May of the year of examination

TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

Master of Surgery

In

GENERAL SURGERY

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES

FARIDKOT

MARCH 2021

Dr. HARPRABHJOT KAUR

DEPARTMENT OF GENERAL SURGERY
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA
LUDHIANA, PUNJAB-141001

ABSTRACT OF PLAN OF THESIS

Title	TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY
For the degree of	M.S. General Surgery
Name of the candidate	Dr Harprabhjot Kaur
Supervisor	Dr. Ashish Ahuja, Professor, Department of Surgery, DMCH, Ludhiana
Co-supervisor	Dr. P.S.Nain, Professor, Department of Surgery, DMCH, Ludhiana Dr. Saurabh Arora, Assistant Professor, Department of Endocrinology, DMCH, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Laparoscopic Proximal Jejunal Bypass – Sleeve Gastrectomy (LPJB-SG), a novel metabolic surgery dominates the bariatric scene and is effective in producing weight loss and in remission of type II diabetes. It was first described by de Menezes in 2004.

Aim of Study: To study outcomes of Laparoscopic Proximal Jejunal Bypass – Sleeve Gastrectomy (LPJB-SG) in terms of Weight loss, Nutritional status and Remission of type II Diabetes Mellitus.

Materials & methods: The study will be conducted among the patients admitted to Department of General Surgery, Dayanand Medical College and Hospital, Ludhiana from 1st September 2020 to 31st August 2022. It is both a retrospective and prospective study. Information shall be collected through pre-designed proforma for each patient chosen to be a part of the study with detailed history, clinical examination and complete investigational workup .A pre-operative consent from each patient will be taken.

Clinical Significance: Laparoscopic Proximal Jejunal Bypass – Sleeve Gastrectomy (LPJB-SG), is a feasible, safe and effective surgery for treatment of obesity, long term remission of type II diabetes mellitus and to improve cardiovascular health.

Keywords: Obesity, Bariatric surgery, type II diabetes mellitus, Sleeve gastrectomy, Jejunal bypass

(Signature)	(Signature)	(Signature)	(Signature)	(Signature)
Candidate	Co-supervisor	Co-supervisor	Supervisor	Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY"** exist in the Department of Surgery, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance.

Supervisor

Dr. Ashish Ahuja
Professor
Department of General Surgery
DMCH, Ludhiana

Co-Supervisor

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Professor
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DMCH, Ludhiana

Dr. Saurabh Arora
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Head of the Department

Dr. Jaspal Singh
Professor & Head
Department of General Surgery
DMCH, Ludhiana

Place : _____

Date : _____

APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	Dr. Harprabhjot Kaur
Department	General Surgery
Topic of Thesis	TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY
Likely date of appearing in PG examination	MAY 2023
Date of enrollment	26th July, 2020
Name of Head of Department	Dr. Jaspal Singh
1) **Supervisor** 2) **Co-Supervisor**	Dr. Ashish Ahuja Dr. P. S. Nain Dr. Saurabh Arora
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. Ramit Mahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)	Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)
Dr. Gurpreet S Wander (Vice Principal)	Dr. Gurpreet S Wander (Vice Principal & Professor & Head, Cardiology)
	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / No

Dr. Sandeep Puri
Chairperson
Research Committee

Approved: Yes / ~~No~~

Prof. Arvind Malhotra
Chairman
Ethics Committee

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	DR. HARPRABHJOT KAUR BELA ROAD C/O HMT RESORT ROPAR.
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL , LUDHIANA
3	COURSE OF STUDY AND SUBJECT	MS GENERAL SURGERY
4	DATE OF ADMISSION OF COURSE	26TH JULY 2020
5	TITLE OF THE TOPIC	TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY

6. BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR THE STUDY

There has been a rapid rise in incidence of obesity and its associated metabolic consequences in Asia where 60% of the world population resides and who are already at an elevated risk of developing diabetes.[1]

With the advent of rapid urbanization, shift of diet preferences and sweeping socio-cultural changes in Asia, obesity and its associated metabolic consequences have risen to alarming proportions.[1-3]

Asians, in general are different phenotypically from Caucasians and it has been recognized that Asians are genetically more prone to metabolic syndrome , adiposity and are at a heightened risk for cardio-vascular mortality.[3-5]

Hence what would be ideal is a surgery tailored to the patients' uniquely altered physiology that would give the best possible results while minimizing the adverse effects. Though bariatric surgery has evolved through the years, there is a scope for further refinement as our knowledge and understanding of the processes that lead to and sustain obesity grows. Newer surgeries and innovations need to be designed that incorporates this knowledge and which can be shown to be equally or more effective while minimizing the short and long term adverse effects seen in the currently performed obesity surgeries.[6]

Recently, Laparoscopic Proximal Jejunal Bypass – Sleeve Gastrectomy (LPJB-SG), a novel metabolic surgery dominates the bariatric scene and is effective in producing weight loss and in remission of type II diabetes. It was first described by de Menezes in 2004. It has been seen that LPJB with SG is technically simple and reversible with effective weight loss and diabetes remission in patients with BMI ≥32.5 kg/m^2. Meal size restriction and macronutrient malabsorption remains the basis of post-operative weight loss. LPJB results in less nutritional deficiencies and post-operative discomfort.. Further publications by de Menezes Ettinger and Alamo showed it to

be an effective surgery in weight loss and in control of the metabolic syndrome in a South American cohort.[7,8]

In terms of percent body fat, obesity can be defined as

1. 25% or greater in men and
2. 35% or greater in women.

Abdominal obesity is defined as

1 . Waist circumference in men of 102 cm or more and

2. Waist circumference in Women of 88 cm or more.

Abdominal fat is located in two major compartments: subcutaneous and visceral. Excess of visceral fat is more strongly related to metabolic risk factors than any other fat compartment.[9]

Obesity is a direct result of technological advance and represents a major challenge for technological society.[9]

The foremost physical consequence of obesity is Atherosclerotic Cardiovascular Disease (ASCVD). A substantial portion of the ASCVD resulting from obesity is mediated by type II diabetes. The sum of the risk factors that predisposes to ASCVD goes by the name of metabolic syndrome. The metabolic syndrome is a constellation of metabolic risk factors that consists of – major risk factors such as:[9]

1. Hypercholestrolemia
2. Hyperglycemia(≥100 mg/dl)
3. Hypertension (≥130/85 mm Hg or on treatment for hypertension)

And emerging risk factors such as:

1. Atherogenic dyslipidemia (Serum elevations of triglycerides, apolipoprotein – B and small low-density lipoprotein LDL particles plus low high –density lipoprotein HDL cholesterol)
2. Insulin Resistance
3. Pro-inflammatory state
4. Prothrombotic state.

A diagnosis of metabolic syndrome can be made if a person has three of the following five features:[9]

- Increased waist circumference (≥102 cm in men and ≥ 88 cm in women)

- Elevated triglycerides (≥150 mg/dl)
- Reduced HDL cholesterol (<40 mg/dl in men and < 50 mg/dl in women)
- Elevated blood pressure (≥130/85 mm Hg or on treatment for hypertension)
- Elevated glucose (≥100 mg/dl)

Diabetes is diagnosed with

1. Fasting glucose ≥ 126 mg/dl and/or
2. 2-hour postprandial glucose ≥ 200 mg/dl or
3. Impaired glucose tolerance (IGT) (2-h glucose 140–199 mg/dl).

In addition, obesity is accompanied by other medical conditions other than ASCVD and diabetes such as fatty liver, cholesterol gall stones, obstructive sleep apnoea, osteoarthritis, polycystic ovary disease. These are commonly found in individuals who carry the metabolic syndrome.[9]

Body Mass Index (BMI) is a surrogate marker for body fat content which is determined by weight (kilograms) divided by height squared (square meters).[9]

Obesity is defined as a

1. BMI (weight in kg/(height in meters)^2) ≥30 kg/m^2, in an overall classification in which the healthy range of weight is 18.5–24.9 kg/m^2,
2. Overweight is 25–29.9 kg/m^2,
3. Class 1 obesity is 30–34.9 kg/m^2,
4. Class 2 obesity is 35–39.9 kg/m^2, and
5. Class 3 obesity is ≥40 kg/m^2.

Some groups further subcategorize this last entity into class 4 obesity (superobesity) as 50–59.9 kg/m^2 and class 5 obesity (super-superobesity) as >60 kg/m^2. The older terminology of morbid obesity, empirically defined as >100 lb (45.4 kg) or 100% over ideal body weight, has been replaced with newer descriptive terms, including class 3 obesity, extreme obesity, or clinically severe obesity. Sleeve gastrectomy with proximal jejunal bypass is a surgical treatment for type 2 diabetes mellitus in patients with a body mass index

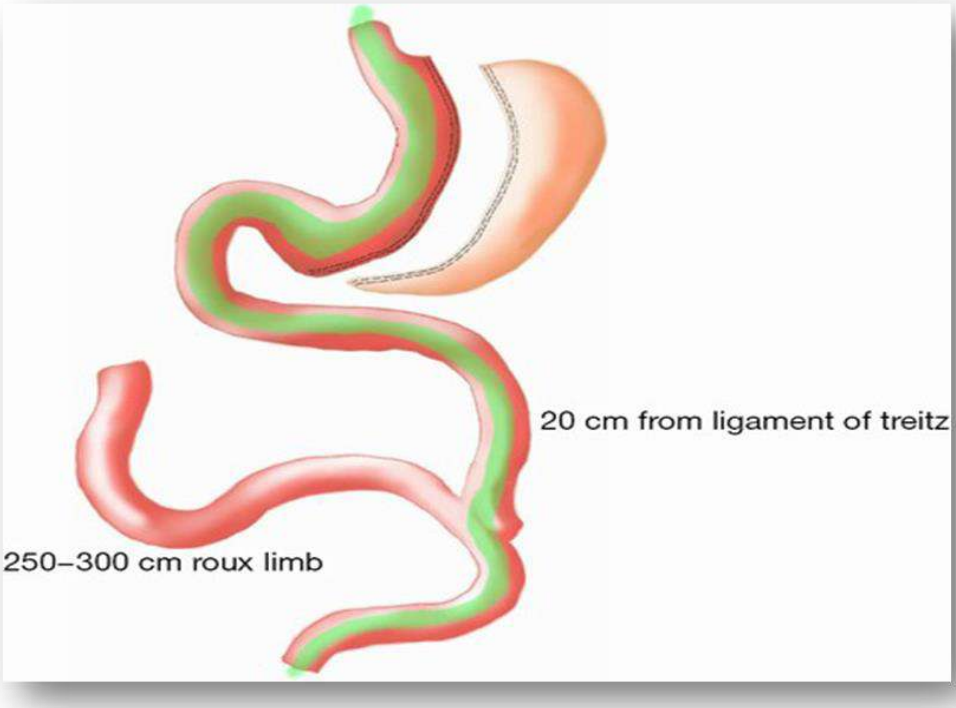
(BMI)< 35Kg/m2. At some point in an obese person's life, the balance between caloric intake and energy expenditure is lost, and only by reestablishing a negative balance can weight loss and resolution of obesity occur. Bariatric surgery provides this counterbalance and allows the patient to realistically achieve weight loss goals and minimize the detrimental effects of comorbid diseases. Surgical therapy for obesity, or "bariatric surgery," is indicated for certain high-risk patients, termed by the National Institutes of Health (NIH) as having "clinically severe obesity."[9-13]

6.2 REVIEW OF LITERATURE

Laparoscopic Proximal Jejunal Bypass – Sleeve Gastrectomy (LPJB-SG) , a novel metabolic surgery dominates the bariatric scene and is effective in producing weight loss and in remission of type II diabetes. It was first described by de Menezes in 2004. The concept was based on a restrictive procedure combined with a jejunal bypass of 300 cm with a Roux limb sutured to the remnant bypassed stomach. This was subsequently modified to excise the remnant stomach.[1]

Firstly, Laparoscopic Sleeve Gastrectomy is done. After that, jejunum is divided 50 cm from the ligament of Treitz . 200-300 cm of proximal jejunum is bypassed and end to side jejunojejunostomy is done. The easiest way to produce an early exposure of the food to the ileum is by bypassing the intervening jejunum. [1]

In this context, it is apt to consider a newer procedure or a modification thereof, that can achieve similar results but which is devoid of long term complications, is less difficult to perform, and is reproducible and reversible.[1]



A study was conducted by Chih-Kun Huang, Rajan Mahendra, Ming-Che Hsin, Po-Chih Chang. Sixty five patients with obesity/uncontrolled

type 2 diabetes underwent LPJB-SG between October 30th, 2014 and April 15th, 2016. Pre-operative data was collected at the time of admission.[1]

Table 1 Patient characteristics and pre-surgical data

Characteristics	Number (N=65)/values	Range/% (SD)
Age (years)	38.72	19–71
Females	33	50.7%
BMI preoperative	45.3	27–92.8/11.74%
T2DM	37	56.9%
Duration T2DM (months)	4.96	1–15
HBA1c	8.26	5.9–11.9
Fasting sugar (mg/dL)	166.4	94–343/55.9%
C-peptide (ng/mL)	3.7	1.5–11.4 (SD: 2.01)
Hypertension	44	67.69%
Dyslipidaemia	56	86.15%
Fatty liver	63	96.92%

The mean operating time was 93.13 minutes (41–180 minutes). The hospital stay was about 2.2 days on average (1–16 days) [1]

There were no intra-operative or immediate complications. The percentage of excess weight loss percentages (%EWL) were 26.44 (range, 4.7–167.4), 44.77 (19.7–169.3) and 65.87 (28.3–210.7) at 1, 3 and 6 months respectively.[1]

Table 2 Reduction in mean HBA1c and improvement in glycaemic status at 1, 3 and 6 months

Variable	1 month	3 months	6 months
HBA1C			
Mean	6.9	6.2	6.0
Range	5.3–9.2	5.2–9	4.8–8.2
HBA1c <6.0, not on OHA			
No.	3	14	10
Percentage	11.5%	60.8%	66.6%
HBA1c <6.5, not on OHA			
No.	5	6	2
Percentage	19.2%	26.0%	13.3%
HBA1c <7.0, on OHA			
No.	5	1	2
Percentage	19.2%	4.3%	13.3%

Reduction in mean HBA1c and improvement in glycaemic status at 1, 3 and 6 months.[1]

Patient were started on oral liquids as sips on the day of the surgery and increased as tolerated. Patients were followed up a week, a month, 3 months later and three monthly thereafter for the first year.[1]

Bariatric surgery (or weight loss surgery) includes a variety of procedures performed on people who are obese. Long term weight loss through standard of care procedures are Laparoscopic Roux en-Y gastric bypass (LRYGB), Sleeve gastrectomy, and Biliopancreatic diversion with duodenal switch This is largely achieved by altering gut hormone levels that are responsible for hunger and satiety, leading to a new hormonal weight set point. Bariatric surgery is a hormonal surgery in these procedures, for which the alteration in gut hormones develops as a result of the procedure's restriction and malabsorption. Long-term studies show the procedures cause significant long-term loss of weight, recovery from diabetes, improvement in cardiovascular risk factors..[1-6]

With the current knowledge of the roles played by intestinal hormones in obesity and diabetes, there is a much better and detailed understanding of the way modification of the gut anatomy produces weight loss and control of metabolic syndrome. de Menezes Ettinger and Alamo had showed it to be an effective surgery in weight loss and in control of the metabolic syndrome.[6-8]

Type 2 diabetes mellitus (T2DM) is a common disease with numerous complications. Studies have elucidated the effects of bariatric surgery on the enteroinsular axis; specifically on a family of peptides involved in the synthesis, secretion, and regulation of insulin: the incretins. In T2DM, the incretin effect is either greatly impaired or absent. Bariatric surgery is an efficient procedure for controlling T2DM in morbidly obese patients [9-12]

A prospective cohort study was conducted by Munir Alamo, Matias Sepulved, Jose Gellona, Mauricio Herrera, Cristian Astorga, Carlos Manterola where patients with T2DM and BMI <35 kg/m^2 who underwent SGJB between January 2009 and June 2011 at DIPRECA Hospital, in Santiago, and Hospital Base, Osorno, Chile were included . Excess weight loss (EWL) and complete or partial remission of T2DM

were reported. Forty-nine patients met the inclusion criteria. The mean age was 49 years (36-62), and 53 % of patients were female. Median EWL at 1, 3, 6, 12, and 18 months postoperatively was 31.9 %, 56.9 %, 76.1 %, 81.5 %, and 76.1 %, respectively. Complete T2DM remission was achieved in 81.6 % of patients (40/49) and partial remission in 18.4 % (9/49). The remission of diabetes occurred in 81.6% of patients with a marked improvement in the remainder. Hence bariatric surgery is seen as an efficient procedure for controlling type 2 DM in morbidly obese patients. [12-13]

Sleeve Gastrectomy in itself gives good results in terms of weight loss and control of metabolic syndrome. An addition of a mal-absorptive component such as a jejunal bypass would be additive in terms of sustainence of weight loss and definitely in the resolution and control of diabetes. LRYGP has a higher incidence of immediate and long term complications including anaemia, marginal ulcers, dumping syndrome and nutritional deficiencies that require lifelong supplements and surveillance. Other mal-absorptive procedures like Bilio-pancreatic diversion, though gives the best results in terms of weight loss and remission of co-morbidities, is fraught with even higher nutritional problems, bowel disturbances and frequent hospital visits.[14,15]

LPJB-SG subscribes to the prevalent and accepted theory of incretins in the remission of diabetes. By early exposure of the food to ileum, there is an increase in GLP-1 and Peptide YY secreted by the L cells of the ileum that has been postulated to decrease apoptosis of beta cells, enhance insulin secretion, decrease glucagon response and also decreases the gastric emptying time. These factors as well as others are responsible for control of diabetes.[16-19]

Given an intact pylorus and longer common channel and, it can be theorized that problems of dumping syndrome and malnutrition of macro/micro nutrients should occurs less. The creation of a blind loop of intestine might cause bacterial overgrowth and the blind loop syndrome. There is no case in the follow-up presenting with symptoms of bacterial overgrowth. Alamo *et al.* consider this occurrence unlikely

since there is no food transit through the bypassed bowel, which the resident bacteria can use as a substrate and that an iso-peristalitic orientation helps in mitigating against this possibility.[20]

A retrospective study included 244 obese patients with BMI ≥ 35 kg/m^2 undergoing Sleeve Gastrectomy + Jejunojejunal Byass (SG + JJB) (n = 83), Sleeve Gastrectomy (SG) (n = 82), and Roux-en-Y gastric bypass (RYGB) (n = 79). In subgroup case-matched study, SG + JJB exhibited superior weight loss effect to SG regarding total weight loss (38.8 ± 8.7% vs 35.0 ± 6.1%, P = 0.011) and excessive weight loss (95.3 ± 20.4% vs 86.9 ± 13.7%, P = 0.033) at 1-year follow-up. SG + JJB yielded less postoperative complications than RYGB regarding anemia (4.8% vs 22.8%), vitamin D deficiency (47.0% vs 65.8%), vitamin B12 deficiency (8.4% vs 25.3%), hypoalbuminemia (1.2% vs 8.9%), diarrhea (6.0% vs 21.5%), dumping syndrome (0 vs 7.6%), and fatigue (25.3% vs 40.5%) (P < 0.05).[21]

In another retrospective study, Matias Sepulveda, Munir Alamo, Juan P.Valderas compared the efficacy and safety of Sleeve Gastrectomy - Jejunal Byass (SGJB) versus RYGB in terms of T2D remission up to 3 years postoperatively. Two groups of patients with T2D who underwent SGJB or RYGB were taken. The diabetes remission rate was similar between the SGJB and RYGB groups at 1 year postoperatively (69.2 vs. 64.7%) and 3 years postoperatively (56.1 vs. 58.8).[22]

A 32-year old Female with BMI of 31 and had more than 10-years history of poorly-controlled Type 2 DM. Glycosylated hemoglobin (HbA1c) was 9.4% and had been on multiple hypoglycemic medications with nil improvement. She underwent Laparoscopic Sleeve Gastrectomy with Proximal Jejunal Bypass (LSG-PJB). Six months follow-up showed marked improvement in glycemic control. She was off-medications as early as Day 3 post-op and had been in complete remission. HBA1c is 4.8% and BMI has decreased from 31 to 22. Proximal Jejunal Bypass (PJB), which involves the exclusion of the proximal small intestine from nutrient flow thereby down-regulating unidentified anti-incretin factor, is done in addition to the conventional

Sleeve Gastrectomy. These two procedures combined result in a synergistic, long-term improvement in glycemic control compared to Sleeve Gastrectomy alone.[12]

6.3 AIMS AND OBJECTIVES OF THE STUDY

To study the Outcomes of Laparoscopic Proximal Jejunal Bypass with Sleeve Gastrectomy (LPJB-SG) in terms of weight loss, Nutritional status and Remission of type II diabetes

7. MATERIALS AND METHODS

7.1 Source of Data

This is a Retrospective and Prospective study conducted among the patients admitted to department of General Surgery, Dayanand Medical College and Hospital, Ludhiana from 1st September 2020 to 31st August 2022 (including followup).

7.2 METHOD OF COLLECTION OF DATA

Information shall be collected through pre-designed proforma for each patient chosen to be a part of the study with detailed history, clinical examination and complete investigational workup including . A pre-operative consent from each patient will be taken

INCLUSION CRITERIA-

- Patients undergoing Laparoscopic Proximal Jejunal Bypass – Sleeve Gastrectomy (LPJB-SG) for obesity (BMI > 32.5) and failure of medical therapy.
- Morbid obesity as defined as those with BMI >32 with / without diabetes.

EXCLUSION CRITERIA-

Patients with

1. Age < 18 years
2. Pregnancy
3. Pyschiatric illness
4. Peptic ulcer disease
5. Advanced cases of malignancy

METHOD OF COLLECTION OF DATA:

The study will be conducted on patients with initial measurements of height, weight, BMI, body fat composition analysis, subcutaneous fat, skeletal muscle, skeletal muscle index, fat%, visceral fat, resting metabolism, baseline blood studies, pulmonary , thyroid and liver function tests, lipid profile, fasting blood sugar , 2-hour post prandial glucose, glycosylated hemoglobin , continuous glucose monitoring with sensor. Body composition analysis will be done through Body composition monitor depicting a personal number symbol of the patient

These values will be compared at the time of admission and post-operatively at 4 months. Continuous glucose monitoring sensor measures the amount of glucose in the fluid inside your body. The sensor is placed on the back of arm of the patient for a period of 14 days. The information is read with the help of a reader. It displays the sugar levels at intervals. If the blood sugar drops to a dangerously low level or a high preset level, the monitor will sound an alarm

SAMPLE SIZE – Time Bound Study

FOLLOW – UP PERIOD – 4 months

DURATION OF STUDY – From 1st September 2020 to 31st August 2022 (Including followup)

OUTCOME

The study will analyse weight loss, nutritional status, remission of type II diabetes in patients with improvements in their quality of life.

STATISTICAL ANALYSIS

Data will be described in the terms of range, mean +/- standard deviation, frequencies (number of cases), and relative frequencies (percentages) as appropriate. Comparison of quantitative variables will be done using paired t-test. A probability value of less than 0.05 will be considered statistically significant. All statistical calculations will be done using SPSS ver.21.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO, PLEASE DESCRIBE BRIEFLY.

Hemogram, RFT, PTI/INR, Viral Markers, ECG, CXR, LFT, Pulmonary and thyroid function tests ,USG abdomen , FBS , 2 Hour post prandial glucose, HBA1C, Lipid profile, Albumin, Continuous glucose monitoring sensor , Body composition analysis monitor.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Attached here with

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PROFORMA

SERIAL NO:

NAME:

AGE/SEX:

M.R.D.NO:

Adm. NO:

DOA:

DOD:

ADDRESS:

History of Present illness:

Past History:

- Medical treatment for obesity
- Any other therapy for obesity

Other Comorbidities:

History of Diabetes Mellitus

Hypertension

CAD

PCOD

OSA

Thyroid disease

Signature of Candidate

Signature of Supervisor

Previous Treatment / Surgery / Intervention biopsy :

Occupation:

General Physical Examination:

Apperance -

BP -	Pallor -	Lymphadenopathy -
PR-	Icterus -	Edema -
RR-	Cyanosis-	Petechie/ Purpura -
Temp -	Clubbing -	Others -

SpO2 (On room air)

Significant Systemic Examination:

Chest -

Per – Abdomen -

CVS -

CNS -

Signature of Candidate

Signature of Supervisor

Investigations

	Pre- Operatively	After 4 Months
Blood Pressure(Systolic/ Diastolic mm Hg)		
Height (m^2)		
Weight (Kg)		
BMI (Kg/m^2)		
Waist Circumference		
Hip/Waist Ratio		
Hemoglobin		
S.Creatinine		
S.Triglycerides		
LDL		
HDL		
Fasting Blood Sugar		
2-hour Post- Prandial		
HBA1c		
SGOT		
SGPT		
Albumin		
Subcutaneous fat • Whole body • Trunk • Arms • Legs		
Skeletal Muscle • Whole body • Trunk • Arms • Legs		
• Skeletal Muscle Index		
Body fat percentage (%)		
Visceral fat (%)		
Resting Metabolism(kcal)		
Body Age		
Continuous Glucose Monitoring Sensor (CGMS)- Time in Range		

Surgery Performed

Signature of Candidate **Signature of Supervisor**

INFORMED PATIENT CONSENT

Date: _____

I.....D/o, W/o, S/o..... am willing to participate in the study **"TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY"** The procedure with its complications has been explained to me in local vernacular language. I have fully understood that no special tests and extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

....

Signature of the Witness Signature of the patient

Name:

Signature of Candidate **Signature of Supervisor**

मरीज अनुमति फार्म

तिथि _____

मैं _____ पत्नी/पुत्र/पुत्री _____

निवासी _____

इस शोधकार्य **"TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY"** में भाग लेने के लिए सहमत हूँ। मैं इस शोधकार्य में भाग लेने के लिए अपनी स्वेच्छा से तैयार हूँ। मैं पुष्टि करता/करती हूँ की यह स्वीकृति देने के लिए मुझे कोई आर्थिक प्रलोभन नहीं दिया गया और न ही दबाव डाला गया है। मुझे इस शोधकार्य का उद्देश्य स्पष्ट कर दिया गया है और मुझे यह विश्वास है की यह विज्ञान और मानवता के लाभ के लिए है। मुझे इस शोधकार्य में होने वाले जोखिम के बारे में समझा दिया गया है और मेरी समझ में यह जोखिम बहुत मामुली है।

मैं इस शोधकार्य में भाग लेने के सम्बन्ध में किसी भी समय अपनी अस्वीकृति व्यक्त कर सकता/सकती हूँ और मेरे अस्वीकृति व्यक्त करने का मेरे इलाज पर कोई प्रभाव नहीं पड़ेगा।

_____ _____

गवाह के हस्ताक्षर रोगी के हस्ताक्षर/अंगूठे का निशान

नाम: नाम:

_____

अन्वेषक के हस्ताक्षर

_____

विद्यार्थी के हस्ताक्षर

ਮਰੀਜ਼ ਰਜ਼ਾਮੰਦੀ ਫਾਰਮ

ਮਿਤੀ_____

ਮੈ_____ਪਤਨੀ/ਪੁੱਤਰ/ਪੁੱਤਰੀ_____

ਵਾਸੀ _____

"TO STUDY OUTCOMES OF LAPAROSCOPIC PROXIMAL JEJUNAL BYPASS WITH SLEEVE GASTRECTOMY" ਤੇ ਚਲ ਰਹੀ ਖੋਜ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਰਜ਼ਾਮੰਦ ਹਾਂ। ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਮੈ ਆਪਣੀ ਮਰਜ਼ੀ ਨਾਲ ਤਿਆਰ ਹਾਂ। ਮੈ ਇਹ ਦਸਣਾ ਚਾਹੁੰਦਾ ਹਾਂ/ ਚਾਹੁੰਦੀ ਹਾਂ ਕੇ ਇਹ ਰਜ਼ਾਮੰਦੀ ਦੇਣ ਵਾਸਤੇ ਮੈਨੂ ਕਿਸੇ ਵੀ ਤਰਾਂ ਦਾ ਲੋਭ-ਲਾਲਚ ਨਹੀ ਦਿੱਤਾ ਗਿਆ ਅਤੇ ਨਾ ਹੀ ਕੋਈ ਦਬਾ ਪਾਇਆ ਗਿਆ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਦਾ ਮਨੋਰਥ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਭਰੋਸਾ ਦਵਾਇਆ ਗਿਆ ਹੈ ਕੇ ਇਹ ਖੋਜ ਵਿਗਿਆਨ ਅਤੇ ਮਾਨਵਤਾ ਦੀ ਭਲਾਈ ਲਈ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਵਿਚ ਹੋਣ ਵਾਲੇ ਖਤਰੇ ਬਾਰੇ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ ਅਤੇ ਮੈਨੂ ਇਹ ਯਕੀਨ ਹੈ ਕੇ ਇਹ ਖਤਰਾ ਬਹੁਤ ਮਾਮੂਲੀ ਹੈ। ਮੈਨੂ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਦਾ ਢੰਗ – ਤਰੀਕਾ ਸਮਝਾ ਦਿੱਤਾ ਗਿਆ ਹੈ।

ਮੈ ਇਸ ਖੋਜ ਕੰਮ ਵਿਚ ਹਿੱਸਾ ਲੈਣ ਬਾਰੇ ਆਪਣੀ ਰਜ਼ਾਮੰਦੀ ਕਿਸੇ ਵੀ ਸਮੇ ਵਾਪਸ ਲੈ ਸਕਦਾ ਹਾਂ/ ਸਕਦੀ ਹਾਂ ਅਤੇ ਮੇਰੀ ਰਜ਼ਾਮੰਦੀ ਵਾਪਸ ਲੈਣ ਦਾ ਮੇਰੇ ਇਲਾਜ ਤੇ ਕੋਈ ਅਸਰ ਨਹੀ ਹੋਵੇਗਾ।

_____
ਗਵਾਹ ਦੇ ਹਸਤਾਖਰ

_____
ਮਰੀਜ਼ ਦੇ ਹਸਤਾਖਰ

ਮਿਤੀ_____

ਮਿਤੀ_____

ਪਤਾ _____

ਪਤਾ _____

_____
ਨਿਰੀਖਕ ਦੇ ਹਸਤਾਖਰ

_____
ਸਿਖਿਆਰਥੀ ਦੇ ਹਸਤਾਖਰ